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CONTENTS OF PREVIOUS NUMBER

FEBRUARY 1947. NUMBER 2

Congenital Cysts of the Tongue, the Floor of the Mouth, the Pharynx and the Larynx. Gordon B. New, M.D., Rochester, Minn.

The Junction of the Nasal Cavity and the Pharyngeal Tube in the Rat. George Kelemen, M.D., Boston.

Streptomycin Used in the Treatment of Suppurative Otitis Media: A Preliminary Report. John B. Holt, M.D., and Frank B. Snell, M.D., Baltimore.

Measurement of the Overflow Capacity of the Maxillary Sinus and Its Significance. Ben R. Dysart, M.D., Pasadena, Calif.

Role of Columellar and Septocolumellar Sutures in Rhinoplasty. Jacob Daley, M.D., New York.

Dental Treatment of Trismus, Tinnitus, Otalgia and Obscure Neuralgias. William J. Kelly, D.D.S., Cranford, N. J., and Henry W. Langheinz, Ph.G., D.D.S., Elizabeth, N. J.

Clinical Notes; New Instruments and Technics:

Correction of Prominent Ears. D. F. Weaver, M.D., Detroit.

An Acrylic Obturator Employed in the Repair of an Obstructed Frontonasal Duct. Gordon B. New, M.D., and John B. Erich, M.D., Rochester, Minn.

Otosclerosis: An Index of the Literature, with Abstracts, for 1944-1945. Edmund P. Fowler, M.D., New York, Editor.

Progress in Otolaryngology. Summaries of the Bibliographic Material Available in the Field of Otolaryngology:

Peroral Endoscopy. Louis H. Clerf, M.D., and James T. Spencer Jr., M.D., Philadelphia, and Commander Shirley A. Fuhring (MC), U. S. N.

News and Comment.

Abstracts from Current Literature.

Book Reviews.

Directory of Otolaryngologic Societies.

ARCHIVES OF OTOLARYNGOLOGY

VOLUME 45 MARCH 1947 NUMBER 3

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SINUSITIS

The Treatment Practiced in an Air Force Hospital

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AND
CAPTAIN JOHN F. DALY
MEDICAL CORPS, ARMY OF THE UNITED STATES

SIMPLE INFECTION of the upper respiratory tract assumes great importance in the Air Force because of the time that is lost by flying personnel as a result of its complications. The rapid changes of pressure that take place during flight not only aggravate the symptoms of the common cold but also cause the infected secretions to spread into the sinuses and the eustachian tubes. It is this that will ground a man for prolonged periods. Hence, the importance of eliminating any abnormality of the nose or the throat which will cause spread of infection. This, in many cases, involves removal of infected tonsils, correction of deviations of the nasal septum and treatment of lymphoid tissue of the nasopharynx. Once infection has become established, every measure should be used in preparing the patient to return to flying status.

The ultimate goal is to correct the deformity and the abnormality so that the patient may continue with training, or if infection occurs while the patient is on flying status, the object is to return him to full military duty as soon as possible.

We have felt that the old methods and principles of the treatment of sinusitis must be reevaluated in the light of chemotherapy and biotherapy. Sulfonamide drugs, penicillin and tyrothricin have become useful adjuncts of the treatment of infections of the sinuses. In this connection it is important to emphasize the necessity of culturing material from the infected regions in order to determine the type of therapy to use and also the operative procedure to be employed.

ACUTE SINUSITIS

In this group we have cases in which infection persists after an acute attack of nasopharyngitis or in which infection of the sinuses is severe enough to demand definitive treatment. The basis of the treatment is to deal conservatively with the inflamed tissues by employing mild shrinking agents and by cleansing the nose, by nasal irrigation with saline solution and spot suction, and to assist the defense of the body

tissues with adequate chemotherapy, using either sulfonamide compounds or penicillin or both. In using sulfonamide drugs, we have been prescribing sulfadiazine almost exclusively.

In acute frontal sinusitis, if obstruction is not relieved by shrinkage, the middle turbinate bone is fractured toward the midline. If pain persists even though the patient has been given adequate amounts of sulfadiazine or penicillin, making an opening through the floor of the frontal sinus with a trephine has been found to be a simple and satisfactory method of treatment. This is preferred to traumatizing the nasofrontal duct in attempts at irrigation of the sinus. No attempt is made during the operation to disturb the mucous membrane of the sinus, which is swollen and inflamed. A rubber tube is inserted, and penicillin or tyrothricin is instilled into the sinus. Postoperatively penicillin is introduced through the rubber tube every four hours. A solution of 200 Oxford units per cubic centimeter is used, and 5 cc. is instilled at a time. The rubber tube may be removed in two or three days. If the nasofrontal duct is still blocked, the sinus will drain through the operative tract. Usually the operative tract heals promptly.

MAXILLARY SINUSITIS

Maxillary sinusitis that persists after a week of conservative treatment is usually treated by irrigation. We avoid early irrigation because it is felt that it only adds trauma to the edema and inflammation of the tissues. Frequently with shrinkage alone the antrum may drain spontaneously and the infection subside. Various types of irrigating solutions have been used. We have not been able to determine their superiority over isotonic solution of sodium chloride. It is felt that instilling a solution in the antrum does not bring it in contact with the infected membranes long enough for it to become effective. At the time of the irrigation cultures are made, and if the infection is severe enough, penicillin or sulfadiazine is prescribed, to be administered systemically. The simple maxillary sinusitis will clear after two or three irrigations about two days apart.

SPHENOETHMOIDITIS

In addition to shrinking the mucosa of the middle turbinate in order to facilitate drainage, early chemotherapeutic systemic treatment is important. An infection of the antrum is treated at the same time. In our hands the Proetz method has not proved more efficacious than other methods of shrinking nasal tissues. Also the local use of penicillin, introduced into the ethmoid sinuses by the Proetz method, has not proved to be effective.

CHRONIC SINUSITIS

This group includes cases of chronic suppurative sinusitis, characterized by (1) long-standing symptoms, (2) resistance to the usual methods of treatment, (3) physical signs of suppuration and (4) roentgenographic evidence of thickened mucosa with sinal retention of fluid.

In this group one must consider the allergic sinusitis complicated by suppuration. One should not confuse a purely allergic involvement of the sinuses with chronic suppurative sinusitis. Both have long-standing symptoms and thickening of the membranes of the sinuses. The distinction is made by exclusion of suppuration and by the appearance of the nasal mucosa. However, a purely allergic sinusitis may be complicated by chronic suppuration, and proper treatment of the suppuration will alleviate symptoms due to allergy. Cultures are made of the organisms in order to determine the type of chemotherapy and the operative procedure to be used and also in order to make an autogenous vaccine. The vaccine has proved to be a useful adjunct stimulating the patient's immunity.

MAXILLARY SINUSITIS

If, after several washings, there is no indication of resolution of the infection of an antrum, antrostomy is done, and treatment with one of the chemotherapeutic agents is started. Here the bacteriologic report helps in the choice between sulfadiazine and penicillin. We have found, however, that at times only by clinical trial can the effective agent be determined. The effectiveness of the drug can be determined ten days after the use of sulfadiazine and three or four days after that of penicillin has been started. If we find penicillin is effective, we continue its use empirically for seven days. In cases of anaerobic infection the antrostomy seems to be sufficient to eliminate the organism and cure the antrum without the use of sulfadiazine or penicillin.

At the time the antrostomy is done, one should note whether a septal deviation produces obstruction. If it does, a submucous resection of the septum should be done at the same time. It is our experience that removing the anterior tip of the inferior turbinate promotes the draining of the retained secretions through the antrostomy opening. This procedure gives free adequate drainage and aeration to the sinus and has been successful in yielding a cure in the majority of cases. Resort to the Caldwell-Luc operation has been infrequent in our experience. In many cases of severe involvement in which a Caldwell-Luc procedure has been planned, we have found that adequate antrostomy with chemotherapy has eliminated the infection and hastened the resolution of infected mucous membrane even when this has been polypoid in nature.

In those cases of long duration in which the abscesses formed in the mucous membrane are irreversible and polypoid degeneration has

occurred, only removing the diseased tissue through the Caldwell-Luc approach will eliminate the infection. In dealing with antral infections of dental origin, antrostomy will usually suffice. When an oroantral fistula is present and there is polypoid degeneration of the antral mucosa filling the fistula and the antrum, this can best be removed by a radical antrotomy, with the oroantral fistula being closed at the same time.

CHRONIC ETHMOIDITIS

A chronic suppurative infection of the ethmoid cells is usually combined with an infection of the antrum. The first step in dealing with ethmoiditis is to treat the infected antrum. When there is polypoid degeneration of the mucosa of the ethmoid labyrinth sufficient to obstruct drainage, this infected tissue should be removed. If necessary, exenteration of the involved group of cells should be done, and the hypertrophied diseased middle turbinate should be removed in part only, in order to preserve as much functional tissue as possible. High deviations of the nasal septum should be corrected and antrostomy performed at the same time if necessary. The patient is given sulfadiazine or penicillin as indicated by a culture of material prevously obtained. This not only prevents complications but promotes healing by cutting down postoperative infection. Postoperatively intranasal shrinkage is produced, and the antrum is irrigated every other day after the fifth postoperative day.

When chronic suppurative ethmoiditis is associated with osteitis and scarring of the mucous membrane, it has been our experience that surgical intervention does not eliminate the diseased tissue and is often followed by formation of granulation tissue which becomes infected. Hence purulent discharge continues, and the crusting aggravates the nasal symptoms. We have come to rely on adequate treatment of the antrum combined with intramuscular injection of penicillin and administration of sulfadiazine plus use of autogenous vaccine and local measures.

The external operation on the ethmoid sinus was reserved for those patients who had complications—e. g., orbital abscess—or for whom complete removal of diseased membrane was considered necessary because of existing pulmonary infection. Two patients in whom osteitis existed in the presence of chronic involvement of the lung, i. e., bronchiectasis, and who were treated by external operation showed only moderate improvement.

CHRONIC FRONTAL SINUSITIS

A trial of penicillin and sulfadiazine usually cleared up most chronic infections of the frontal sinuses. If chemotherapy failed, removal of the anterior tip of the middle turbinate and removal of any polypoid tissue occurring in the area of the nasofrontal duct promoted drainage. This

minor operative procedure may be required before the chemotherapy is given. The external frontal operation was done only when a complication arose. The complications encountered by us were osteomyelitis of the frontal bone with abscess forming in the frontal area and abscess formation posterior to the frontal sinus producing an epidural abscess. We have observed severe spreading osteomyelitis of the skull originating in frontal sinusitis in 3 patients.

CHRONIC SPHENOIDITIS

Chronic sphenoiditis usually accompanied posterior ethmoiditis and was treated in the same fashion. No operations were performed on the sphenoid sinus.

We wish to emphasize the use of autogenous vaccine in dealing with those patients who give a history of recurring attacks of sinusitis. We have found that in spite of the curing of the sinusitis of some patients, reinfection does occur. We believe that if one is able to increase the patient's immunity to the organism that causes the reinfection, recurrences may be avoided and certainly diminished.

SUMMARY

We have presented a review of the methods of treating acute and chronic sinusitis at an Air Force hospital where the primary purpose was to prevent infection of the sinuses and to cure them as quickly as possible in order to return the patients to duty.

A reevaluation of old methods and principles of treatment of sinusitis has taken place in the light of present knowledge of chemotherapeutic agents.

Conservative therapy is emphasized, together with full use of chemotherapeutic agents.

It is important to culture material from the areas involved in order to determine the organism causing the disease, for this determines the type of chemotherapeutic agent and the operation to be employed.

Autogenous vaccine is recommended in cases of recurrent sinusitis.

TREATMENT OF OTITIS MEDIA AND SINUSITIS WITH PENICILLIN

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NEW YORK

THIS article is a clinical report of the use of penicillin in the treatment of infections of the middle ear, sinus and face.

Penicillin has been used both locally and systemically in a group of 27 cases of infection of the middle ear, 17 cases of sinusitis and 8 cases of infection of the face or neck. The technic for the treatment by topical application of penicillin was as follows: (1) Proetz's displacement with penicillin solution in isotonic solution of sodium chloride (1,000 to 10,000 units per cubic centimeter); (2) administration of 5,000 to 10,000 units per cubic centimeter into the maxillary sinuses through a trocar, which was left there, every three hours for a few days; (3) use of ointments of penicillin in the operative cavities, or (4) systemic administration of penicillin, 10,000 to 20,000 units every three hours.

GENERAL CONSIDERATIONS OF RESULTS

I. Systemic Administration.—A. Acute Otitis Media: Intramuscular injections of penicillin, 5,000 to 20,000 units every three hours, were satisfactory. Most of the aural conditions cleared up in this way without any complications. In the early stages of mastoiditis, it was also satisfactory. In conditions complicated by bony destruction and an abscess in the mastoid process, surgical intervention in addition to pencillin was indicated in an attempt to clear up the condition. It is noted, however, that the continuation of penicillin therapy without operation could bring about a dry ear in the aforementioned type of cases; the organized granulations in the attic and in the middle ear may cause a conduction type of deafness.

B. Acute Sinusitis: Intramuscular injections of penicillin with intranasal shrinkage were satisfactory. Penicillin solution can also be administered locally in cases in which irrigation of the sinuses is necessary.

From Columbia University College of Physicians and Surgeons, John D. Kernan, M.D., Director of the Ear, Nose and Throat Service.

TABLE 1.—*Cases of Otitis Media in Children*

Patients	Diagnosis with Clinical Finding	Microbiology	Treatment	Result
M. Ch. (8½ yr.)	Acute purulent otitis media with external otitis; large central perforation; 1 mo. history	Hemolytic Staph. aureus not sensitive to penicillin	Drops of penicillin solution, 1,000 units per cc.	No result with penicillin; culture of material from patient's ear was sensitive to streptothricin, which was used locally; ear dry in 3 days
D. M. (9 yr.)	Congestive otitis media with redness and tenderness on the previous mastoidectomy scar	No discharge from the ear	Penicillin given systemically, 5,000 units every 3 hr.	Symptoms disappeared on second day; condition cured
N. P.	Third attack of acute purulent otitis media in a year; 4 day history	Organisms sensitive to penicillin	Penicillin given systemically, 5,000 units every 3 hr.; drops of penicillin solution in the ear	Ear dry after 4 days; 2 mo. after discharge patient came back with the same complaint; the same treatment was repeated and also tonsils and adenoids were removed; condition cured
A.	Acute purulent otitis media for 2 days	Organisms sensitive to penicillin	Penicillin given systemically, 5,000 units every 3 hr.	Symptoms disappeared; condition cured in 5 days
A. R. (13 mo.)	Intermittent discharge of left ear for 10 mo.	Hemolytic Staph. aureus	Penicillin given systemically, 5,000 units every 3 hr.; adenoidectomy after ear was cured	Ear dry on its third day
L. G. (6 yr.)	Acute purulent otitis media with mastoiditis; 8 day history; facial palsy for 30 hr.	Organisms sensitive to penicillin	Penicillin given systemically, 5,000 units every 3 hr., and mastoidectomy	Discharge stopped from external canal; wound closed on 24th day, and facial palsy disappeared at the end of 1 mo.
J. B.	Chronic purulent otitis media	Hemolytic Staph. aureus; gram-negative cocci	Penicillin solution drops; streptothricin drops in the ear	None; ear dry in 1 wk.
J. O. (3 mo.)	Acute purulent otitis media with postauricular abscess	Hemolytic Staph. albus	Penicillin given systemically, 5,000 units every 3 hr.	Ear dry in 1 wk.; postoperative course uneventful; patient came back with acute purulent otitis media in the same side after 1 mo.; treatment repeated and condition was cured in 3 days
M. D.	Bilateral acute purulent otitis media; postauricular abscess on left; patient had previous mastoidectomies on both sides	Nonhemolytic streptococci	Penicillin given systemically, 5,000 units every 3 hr.; abscess opened	Ear dry in 5 days; wound closed in 15 days
E. A. (8 mo.)	Acute purulent otitis media	Nonhemolytic Staph. albus	Penicillin given systemically, 5,000 units every 3 hr.	Condition cured in 9 days
W. T. (7 yr.)	Exacerbation of chronic purulent otitis media; patient had mastoidectomy 1½ years before; draining has not stopped since	?	Penicillin given systemically, 5,000 units every 3 hr.	Ear dry after 9 days; condition cured
C. A. (baby)	Bilateral acute purulent otitis media with thickened drums	Diphtheroids; H. influenzae	Penicillin given systemically, 5,000 units every 3 hr.	24 days' hospitalization; no good result was obtained; patient still under outpatient care for intermittent aural discharges
H. S.	Bilateral acute purulent otitis media with a profuse discharge	Right ear: Pneumococcus type I; left ear: hemolytic Staph. albus	Penicillin given systemically, 5,000 units every 3 hr.	Ears dry in 5 days; condition cured
F. K.	Acute purulent otitis media for 2 wk. with tenderness in the mastoid	Streptococci; overgrown B. subtilis	Penicillin given systemically, 5,000 units every 3 hr.	Ear dry in 7 days
M. E. (4 yr.)	Acute purulent otitis media in left ear for 4 days; high temperature	Hemolytic streptococci	Penicillin given systemically, 5,000 units every 3 hr.	Ear dry on third day

TABLE 2.—*Cases of Otitis Media in Adults*

Patients	Diagnosis with Clinical Finding	Microbiology	Treatment	Result
R. S.	Bilateral subacute purulent otitis media and diabetes	Right: hemolytic Staph. albus; left: Pneumococcus type III; hemolytic Staph. albus	Penicillin given systemically, 20,000 units every 3 hr.; insulin	Ear dry on fifth day; condition cured
A. H. (36 yr.)	Acute purulent otitis media for 20 days; mastoiditis; severe headache	Hemolytic streptococci; Staph. albus	Penicillin given systemically, 20,000 units every 3 hr.; mastoidectomy with pathologic exposure at the tegmen antri	Condition cured; operative result successful
S. J. (34 yr.)	Acute purulent otitis media in the right ear for 1 wk.; profuse discharge	Hemolytic streptococci	Penicillin given systemically, 20,000 units every 3 hr.	Ear dry in 5 days; condition cured
Y. K. (50 yr.)	Acute purulent otitis media in the left ear for 3 wk.	Hemolytic Staph. aureus; diphtheroids	Penicillin given, 25,000 units every hour	Ear dry in 1 wk.; condition cured
W. B. (52 yr.)	Acute purulent otitis media for 1 wk.	Pneumococcus type III	Penicillin given systemically, 20,000 units every 3 hr.	Ear dry in 8 days; condition cured
I. A. (53 yr.)	Subacute otitis media	Staph. aureus	Penicillin given systemically, 20,000 units every 3 hr.	Condition cured
A. K. (70 yr.)	Acute purulent otitis media and external otitis for 1 wk.	Hemolytic Ps. aeruginosa	Penicillin given systemically, 10,000 units every 3 hr.	Ear dry on third day; condition cured
K. S. (22 yr.)	Subacute purulent otitis media for 1 mo.	Hemolytic streptococci	Penicillin given systemically, 10,000 units every 3 hr.	Ear dry in 8 days; condition cured
G. W. (15 yr.)	Acute purulent otitis media for 3 wk.	Hemolytic streptococci; hemolytic Staph aureus	Penicillin, 25,000 units every 3 hr.	Ear dry in 6 days; condition cured
J. S. (59 yr.)	Subacute purulent otitis media for 3 mo. with zygomatic abscess	Pneumococcus type III	Penicillin given systemically, 20,000 units every 3 hr.; mastoidectomy	Postoperative course uneventful
Ch. J. (47 yr.)	Subacute purulent otitis media and mastoiditis	Pneumococcus type III	Penicillin given systemically, 20,000 units every 3 hr.; mastoidectomy	Postoperative course uneventful
F. P. (40 yr.)	Chronic labyrinthitis with a large fistula in the horizontal semicircular canal; dizziness; total loss of hearing in the same side (left)	.....	Labyrinthectomy, under systemic administration of penicillin, 20,000 units every 3 hr.	Postoperative course uneventful and a good result

II. Local Application of Penicillin.—A. Acute, Subacute and Chronic Sinusitis: Local application was satisfactory when the micro-organisms were sensitive to penicillin. In acute sinusitis, daily irrigations and the administration of penicillin were successful. In subacute and chronic conditions, it is necessary to place a cannula in the antrum in order to

TABLE 3.—*Cases of Sinusitis in Children*

Patients	Diagnosis with Clinical Finding	Micro-biology	Treatment	Result
B. B. (9 yr.)	Chronic pansinusitis with significant roentgenologic findings	Nasal: hemolytic Staph. aureus sensitive to penicillin	Daily treatment with Proetz's displacement with penicillin solution, 1,000 units per cc.	Nasal discharge stopped and condition cured
N. V. (12 yr.)	Chronic pansinusitis with significant roentgenologic findings	Organisms sensitive to penicillin	Daily treatment with Proetz's displacement with penicillin solution, 1,000 units per cc.	Condition cured in 9 days
A. R. (13 mo.)	Subacute pansinusitis with a profuse discharge from the nose	?	Daily treatment with Proetz's displacement with penicillin solution, 1,000 units per cc.	Nasal discharge stopped on fifth day; condition cured
G. R.	Chronic pansinusitis	?	Daily treatment with Proetz's displacement with penicillin solution, 1,000 units per cc.	Nose dry on sixth day; condition cured
P. M. (14 mo.)	Acute ethmoiditis with cellulitis of left orbit; 1 wk. history; high temperature	Hemolytic Staph. aureus	Daily treatment with Proetz's displacement with penicillin solution, 1,000 units per cc. and systemic administration of penicillin, 15,000 units every 3 hr. with the external incision of the left ethmoid region	Symptoms subsided gradually; condition cured in 1 mo.
M. P. (3 yr.)	Chronic pansinusitis with thick mucopus; significant roentgenologic findings	Hemolytic staphylococci sensitive to penicillin	Local and systemic administration of penicillin as in foregoing cases and even in higher concentration did not do any good in this case	

apply penicillin every three hours and to administer daily irrigations for a few days. A rubber catheter would be more useful for this purpose.

B. Postoperative Use After Simple Mastoidectomy: In patients who had been operated on for simple mastoidectomy, packing with penicillin ointment was satisfactory in preventing secondary infections and for quick healing of the wound.

In cases of involvement of the mastoid in which radical operation had been done, the use of penicillin ointment packings usually brought about

a narrowed cavity, due to the excessive healthy-looking granulations. The application of penicillin only once or twice in profusely discharging cavities usually creates a dry cavity and shortens the time of healing.

TABLE 4.—*Cases of Sinusitis in Adults*

Patients	Diagnosis with Clinical Finding	Treatment	Result
A. F.	Chronic purulent maxillary sinusitis on right side	Local application of penicillin solution, 10,000 units per cc. every 3 hr.	Condition cured in 4 days
L. W. (28 yr.)	Bilateral chronic purulent maxillary sinusitis	Local application of penicillin solution, 10,000 units per cc. every 3 hr.	Condition cured in 6 days, but patient came back with pus in the sinuses in 1 wk.; treatment repeated, no result
I. G. (59 yr.)	Chronic purulent maxillary sinusitis on right side	Systemic administration of penicillin, 10,000 units every 3 hr.; also locally 20,000 units once a day	Condition cured in 8 days
J. K. (36 yr.)	Chronic purulent maxillary sinusitis	Local administration of penicillin solution, 10,000 units every 3 hr.	Condition cured in 2 days
H. G.	Bilateral chronic purulent maxillary sinusitis with closed previously performed permanent openings	Local administration of penicillin solution, 10,000 units every 3 hr.	Condition cured in 5 days
M. L.	Chronic purulent pansinusitis	Local administration of penicillin solution, 10,000 units every 3 hr. for maxillary sinuses	Both maxillary sinuses were cured in 4 days
Z. M. (20 yr.)	Chronic purulent maxillary sinusitis on right side	Local administration of penicillin solution, 10,000 units every 3 hr. and permanent opening	No result
E. G. (43 yr.)	Bilateral chronic purulent maxillary sinusitis	Local administration of penicillin solution, 10,000 units every 3 hr.	Little improvement
C. A. (42 yr.)	Bilateral chronic ethmoidal and maxillary sinusitis	Local administration of penicillin, 10,000 units every 3 hr.; permanent openings; Caldwell-Luc operation and intranasal ethmosphenoidectomy on left	No result with penicillin
M. F. (25 yr.)	Chronic purulent maxillary sinusitis	Local administration of penicillin, 10,000 units every hour	Little improvement
J. F.	Chronic purulent maxillary ethmoidal sinusitis and sphenoiditis on right side	Local administration of penicillin, 10,000 units every hour; Caldwell-Luc operation and intranasal ethmosphenoidectomy	No result with penicillin

C. Complicated Cases with Extracranial and Intracranial Involvement Due to Acute and Chronic Otitis Media: These conditions can almost always be controlled and the operative procedure can be carried out under more satisfactory conditions with administration of penicillin.

TABLE 5.—*Cases of Infection of the Face and Neck*

Patients	Diagnosis with Clinical Finding	Treatment	Result
F. H. (28 yr.)	Cellulitis of the left side of the face; acute purulent maxillary sinusitis and dental abscess	Systemic administration of penicillin, 20,000 units every 3 hr.; local use of penicillin solution, 10,000 units in the maxillary sinus every 3 hr.	Condition cured in 10 days
H. G. (16 yr.)	Suppurative parotitis with high temperature; hemolytic streptococci	Systemic administration of penicillin, 10,000 units every 3 hr.	Condition subsided in 6 days; patient came back on the day of discharge from hospital with a return of the condition; treatment repeated and condition was cured in a second 6 day period
K. W. (25 yr.)	Cellulitis of the face, with high temperature	Systemic administration of penicillin, 10,000 units every 3 hr.	Condition cured in 5 days
E. O. (38 yr.)	Furuncle of the nose, with high temperature; staphylococci	Systemic administration of penicillin, 10,000 units every 3 hr.	Condition cured in 5 days
S. T. (70 yr.)	Infectious edema of the larynx; high temperature; no hemolytic streptococci	Systemic administration of penicillin, 2,000 units every 3 hr.	Condition cured in 8 days
R. M.	Abscess of the neck; high temperature; hemolytic staphylococci	Incision and systemic administration of penicillin, 20,000 units every 3 hr.	Condition cured in 10 days
D. M. (36 yr.)	Acute inflammation of the right auricle and cavity from previous radical mastoidectomy on the same side; hemolytic staphylococci and Ps. aeruginosa	Local application of penicillin solution and systemic administration of sulfonamide drugs	Condition cured in 3 days
R. CH. (24 yr.)	Cellulitis of the left side of the face; high temperature	Penicillin given systemically, 10,000 units every 3 hr.	Condition cured in 4 days

SUMMARY

(Treatment with penicillin in otorhinolaryngology given in this article is only a clinical presentation of reports of cases.)

Penicillin is an excellent drug to use locally and systemically in the nose, throat and ear field. If time is taken and patients for whom operation is considered are patiently treated, one may expect to clear the condition without a surgical attempt. This is especially true of sinusitis with chronicity when the saving of nasal structures, which is important from the physiologic point of view, is a great advantage. It is also efficacious in acute cases of otitis media, guaranteeing the patient's hearing and preventing further complications.

USE OF "ISO-PAR" OINTMENT IN THE TREATMENT OF OTITIS EXTERNA

WILLIAM T. REARDON, M.D.
WILMINGTON, DEL.

THIS ARTICLE is based on a report sent to the Surgeon General's office from Okinawa, a report which was made in an endeavor to have the new drug Iso-Par, put on the accredited list and thereby made available to those medical officers who cared to use it in the service.

Since the writing of this article early in 1946, I have been informed by the Surgeon General's office that Iso-Par ointment has been put on the standard list for the Army and that the drug has been urgently recommended in the Pacific.

I was the E. E. N. T. officer of the 27th Station Hospital, which functioned at New Caledonia for two and one-half years and on Okinawa from May 1945 until after VJ Day. During that time the outpatient department of this hospital was the largest on either of the two islands. Owing to the fact that this hospital was stationed for a long period in one place, it was possible to follow individual cases and observe the results of treatment. In 1943 the E. E. N. T. outpatient department gave an average of 800 treatments a month, and in 1944 this average increased to 1,300 treatments a month. Twenty per cent of the patients were seen because of otitis externa.

A large percentage of patients gave a history of having had a fungous infection for several months. They had been treated with many different drugs and ointments, but the condition always persisted. Close observation led to the belief that few of the infections complained of were true fungous infections. Only patients who had an elevation of temperature were admitted to the hospital, and therefore it may be stated that the patients who were under close observation were the ones whose aural disease was particularly stubborn and resistant to previous forms of therapy.

These patients complained of a painful, running ear, severe itching of the ear, pain on chewing and tenderness at the angle of the jaw. The pain was more severe at night and was frequently described as a sharp shooting pain within the ear.

On examination there was often crusting about the orifice of the canal and about the lobe. The canal was swollen and narrowed, and usually a large amount of debris was present which had an odor of new-mown hay. When this was cleaned out, the canal wall was found to

be inflamed and the tympanic membrane to have lost its luster and to show evidences of an inflammatory reaction. Frequently there were multiple hemorrhagic blebs on the canal wall and on the tympanic membrane. The ears presenting these conditions were apparently the most painful and were immediately relieved of pain when the blebs were ruptured. In other cases the otitis externa was a result of irritation due to a discharge of chronic suppurative otitis media. Because of the frequency of a history of swimming preceding the attack, it was thought that the condition was caused by contaminated water. However, it was later found that many of the patients with otitis externa gave no history of swimming. There were also ears with impacted cerumen which became irritated as a result of swimming. Many of the patients were sent from the Solomon Islands, where the condition was common and was known as "jungle rot."

Before arriving at this hospital, most of the men gave a history of having been treated elsewhere with a different drug every time a new medical officer looked at their ears. Most of the ears were purple from tincture of gentian violet. On further questioning a typical history would sound approximately as follows: "My right ear was hurting me for a few days and then started to run. After about six weeks it stopped running, and then the other ear started to hurt and run. The dispensary was putting drops in my ears but they never seemed to clear up." Many patients gave a history of having been hospitalized several times for this same condition.

For my part, I had used sulfathiazole ointment, cresatin (metacresyl acetate), Burow's solution, gentian violet medicinal, Castellani's paint, ichthammol ointment, silver nitrate, merbromin N. F., 5 per cent phenol glycerin solution, merthiolate, metaphen and, later on, penicillin solution—all with poor results. Just about the time that the ears seemed to be improving, they would flare up overnight and the case was back again where it had started. It should be added that penicillin solution not only proved valueless but was the most irritating of all of the drugs used.

Fortunately, about this time a communication was received from Baltimore, containing a report by Dr. Harry R. Slack Jr. on the effect of substituted benzylamine salts of isoparaffinic acids used in infections of the auditory canal. Following the receipt of this report, it was possible to obtain from the manufacturers a quantity of Iso-Par ointment, which contained these salts.[1] This material was reported to be fungicidal, bactericidal and stimulating, and was stated to create sufficient anesthesia to relieve the pain and itching of superficial injuries, infections and eczemas. Its principal value was said to be in the treatment of pruritus ani, pruritus vulvae, certain mycotic infections and eczema of the ear.

1. Unguentum, Iso-Par (see "New and Nonofficial Remedies" 1946, page 135 [or 1945, page 139]), supplied by Medical Chemicals, Inc., Baltimore.

Immediately on receipt of the ointment, it was put to use in cases of otitis externa and an impressive and rapid response was noted. It was found that infections treated in the early stages responded almost immediately; pain subsided, itching ceased and the spread of the condition was checked. Where the conditions had existed for some time prior to beginning Iso-Par therapy, treatments had to be more extensive and response was less rapid but nevertheless steady.

Many of the infections were bilateral, and therefore, in order to reach definite conclusions, one ear was treated with Iso-Par ointment and the other with other agents, previously mentioned. In these cases the use of Iso-Par ointment was found to be far superior to any of the other forms of medication.

Through the generosity of the manufacturers, Iso-Par ointment was supplied to the clinic of the 27th Station Hospital from 1943 until I left Okinawa in 1945, when our hospital unit was inactivated.

The procedure followed in treating otitis externa with Iso-Par ointment was as follows:

The aural canal was thoroughly cleansed with hydrogen peroxide and dried. A ¼ inch (6 mm.) wick, which was cut from a 2 inch (5 cm.) gauze bandage, was saturated with Iso-Par ointment and placed within the canal. This wick was replaced in two days. After about three treatments, the interval was lengthened to three days, then four days and then a week. Usually there was a noticeable improvement on the second visit. When the ear became perfectly dry, it was painted with Castellani's paint and seen every two weeks or once a month to check for any possible recurrence.

When hemorrhagic blebs were encountered, they were ruptured if the patient was complaining of pain; otherwise they were not disturbed. Often the canal of the ear was practically obliterated, owing to the edema, and great care had to be exercised in placing a wick in the ear, because of the exquisite pain. In this type of ear it was found that on the third to the fifth visit the lining membrane would slough off in mass. Another factor which played an important part in treatment in these cases was cleanliness. The involved ear had to be seen often and cleansed thoroughly at each visit and dried before a new wick was inserted. It was definitely established that the ears did better when water was kept out of them. It was also noted that the involvement was usually unilateral and later became bilateral. To avoid this condition, the well ear was cleansed, dried and painted with Castellani's paint. Patients were never discharged. They were told to report back for a monthly check-up, and if reinfection occurred, to report back immediately. To the best of my knowledge, there was only one patient out of hundreds treated whose otitis failed to respond to the therapy described.

As a result of Iso-Par therapy, many days of hospitalization were saved. The patients were able to continue their normal duties, losing only the time required to go to and from the clinic.

In conclusion a number of points should be emphasized which can be of value to the otologist. These points may be summarized as follows:

(*a*) Iso-Par ointment proved to be a specific medicament for the otitis externa seen in the Pacific Area and was found to be far superior to any other used for that purpose.

(*b*) Iso-Par ointment is apparently neither toxic nor irritating and is effective as fungicide, bactericide, anesthetic and stimulant to rapid healing.

(*c*) The toilet of the ear is essential, and the canal should be kept clean and free from water.

(*d*) Otitis externa often recurs, and Castellani's paint should be used as a prophylactic agent.

(*e*) I am using Iso-Par ointment in civilian practice with results equal to those witnessed in the South Pacific.

207 West Twenty-Ninth Street.

STATUS OF PENICILLIN IN THE TREATMENT OF DIPHTHERIA

A Review of the Literature and Report of One Case

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FLEMING, in his original work,[1] reported that the pyogenic cocci and the diphtheria bacilli were the organisms most effectively inhibited by penicillin. He noted with his agar plate method that the diphtheria bacilli were less affected than the pyogenic cocci. He observed that it took a 1 per cent dilution of the filtrate to inhibit the diphtheria organisms, while the cocci were inhibited by a 0.2 per cent dilution. Since then, many investigators have likewise reported that diphtheria bacilli were effectively inhibited in vitro by penicillin. It would seem from this laboratory work, in vitro, that penicillin would be of value in the clinical treatment of diphtheria.

Ercoli, Lewis and Moench,[2] reported that diphtheria bacilli were inhibited by a concentration of 1.25 to 1.5 units of penicillin per cubic centimeter. Partial inhibition was obtained by 0.35 unit per cubic centimeter. Diphtheria toxin was formed by organisms not completely inhibited. They found that penicillin in high doses did not inhibit development of diphtheria in mice. Extremely high doses (45,000 to 300,000 units per kilogram) were ineffective in animals given subcutaneous injections of diphtheria toxin.

Keefer,[3] in his report representing the recommendations of the Office of Scientific Research and Development and the National Research Council, divided the conditions in which penicillin has been found to be the best therapeutic agent available into three groups. With respect to group 2 of these indications, he recommended that penicillin be used in the treatment of patients with diphtheria, especially the patients who were sensitive to horse serum. However, he stated that the therapeutic position of penicillin in this group has not been definitely defined.

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1. Fleming, A.: On Antibacterial Action of Culture of Penicillin, Brit. J. Exper. Path. **10**:226 (June) 1929.

2. Ercoli, N.; Lewis, M. N., and Moench, L. J.: The Antibacterial Activity of Penicillin in Experimental Infections of Mice with C. Diphtheriae, J. Pharmacol. & Exper. Therap. **84**:120 (June) 1945.

3. Keefer, C. S.: Penicillin, Bulletin prepared by the Civilian Penicillin Distribution Unit, War Production Board, Chicago, Ill., December 1944.

A complete review of the literature from 1929 through 1945 reveals little published on the clinical use of penicillin in the treatment of patients with this disease.

Turner,[4] of Australia, using penicillin in a dilution of 250 units per cubic centimeter as nasal guttae at three hour intervals, obtained remarkable results in 3 patients and similar results by painting the fauces in another patient. These patients had all received adequate amounts of antitoxin but the organisms were persistently present in the swabbings. Two of the patients had not improved clinically with the antitoxin; at least the author stated that there was a deterioration in each patient's general condition. In the cases of nasal diphtheria the nasal swabbings had been positive for thirty-three days, twelve days and thirty days, respectively. In the case of pharyngeal diphtheria the swabbings had been positive for thirty-one days. In all of the 4 cases the cultures were negative at the end of twenty-four hours after the local applications of penicillin. In the cases of nasal diphtheria the cultures remained negative. No organisms were found for the next four days in the swabbings from the patient with pharyngeal diphtheria and then the cultures again became positive. The same treatment was repeated with 250 units of penicillin per cubic centimeter of solution. This patient then remained permanently free from these bacilli.

Herrell,[5] in this country, reported that penicillin may have been responsible for the cure of 1 diphtheria carrier.

McDaniels[6] reported a case of diphtheria bacillus infection of a wound that did not respond to penicillin therapy (mode of administration not mentioned) over a period of eleven weeks. The wound healed completely in twelve days with the local and intramuscular use of diphtheria antitoxin. He reported that susceptibility tests run in tryptose broth showed this particular strain of diphtheria bacilli not to be inhibited by less than 640 units of penicillin per cubic centimeter. This was sixteen thousand times the concentration of penicillin required to inhibit a test culture of Staphylococcus aureus (Oxford strain) that was used as a control under the same conditions. He also reported that a virulent strain isolated from a patient with fatal diphtheria took 160 units of penicillin per cubic centimeter before growth was inhibited. In this same test the stock cultures took from 160 to 2.5 units of penicillin per cubic centimeter.

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4. Turner, E. H.: Preliminary Report of Cases Treated with Penicillin at Children's Hospital, Melbourne, Australia, M. J. Australia **2**:205 (Aug. 26) 1944.

5. Herrell, W. E., and Kennedy, R. L.: Penicillin: Its Use in Pediatrics, J. Pediat. **25**:505 (Dec.) 1944.

6. McDaniels, H. E.: Penicillin Resistance of Diphtheria Bacilli, Mil. Surgeon **96**:95 (Jan.) 1945.

Skinner [7] reported on the use of penicillin in 30 cases of persistent diphtheria. He concluded that penicillin does have a bacteriostatic effect in diphtheria patients and carriers. The patients received penicillin only after fifteen days' hospitalization. Three patients received 25,000 units of penicillin for an average of thirteen and a half days. The cultures remained positive. The cultures of 2 of these became negative after 100,000 units had been administered daily for five and fourteen days, respectively. Twenty patients received 50,000 units daily. The cultures of 8 of these remained positive; with respect to 6 of these, negative cultures were obtained after daily treatment with 100,000 units. Five patients received 100,000 units daily, with good results in 4.

Following is a report of a case in which penicillin was used in comparatively large doses intramuscularly in the treatment of a patient with virulent laryngeal diphtheria.

A white woman aged 41 entered St. Luke's Hospital, Boise, Idaho, the evening of Jan. 25, 1945. She had had a sore throat for two days prior to entering the hospital for treatment and gave a history of having been exposed while taking care of a child who died with diphtheria two weeks previous to her entering the hospital. An examination at the time of entry showed both tonsils inflamed and covered with a gray membrane. A smear taken on entry did not show the presence of diphtheria bacilli. Administration of sulfathiazole by mouth was started the following day. The patient's temperature ranged from normal to 100 F., and her general condition was good. On January 27, a diphtheria culture was reported as positive, and penicillin therapy was started. An initial dose of 30,000 units was given intramuscularly and thereafter the same dose was given every three hours. There was no noticeable change in the patient's condition that day or on the following day. On the morning of January 29 the patient complained of difficulty in breathing; her pulse rate was 130, she was cyanotic and toxic, and there was definite laryngeal obstruction.

Examination at 10 a. m. that morning revealed that the membrane had extended from the tonsillar area over the soft palate and down into the hypopharynx and larynx. An emergency tracheotomy was performed at the patient's bedside, and 20,000 units of diphtheria antitoxin was given intravenously immediately. Thirty thousand units more of penicillin was given postoperatively, making a total of 510,000 units. Within the first forty-eight hours after tracheotomy the patient was given a total of 100,000 units of antitoxin. On the second postoperative day the patient showed definite improvement, was taking fluids by mouth and could breathe fairly well through the larynx with the tracheotomy tube closed. The membrane was rapidly receding. From then on the recovery was uneventful. On February 4 the tracheotomy tube was removed, and on February 13 the patient left the hospital.

SUMMARY

No definite conclusion can be drawn as to the status of penicillin in the treatment of diphtheria from the few cases reported in the literature.

7. Skinner, J. W.: Penicillin in Persistent Diphtheria, U. S. Nav. M. Bull. **45**:264 (Aug.) 1945.

It seems from most of the laboratory work done in vitro that penicillin might be effective in the treatment of this disease. Laboratory work that has been done on experimental animals fails to bear this out.

Turner's, Herrell's and Skinner's cases suggest the possible value of the use of penicillin in the treatment of carriers and of patients whose cultures are persistently positive. Turner's work further suggests that local application may be of considerable value. McDaniel's case and his laboratory work, as well as the case reported here, suggest that virulent diphtheria organisms producing human diphtheria are apt to be resistant to penicillin.

However beneficial its use might prove to be in inhibiting the growth of diphtheria organisms, penicillin could have no neutralizing effect on the free toxin already in the circulation and the tissues. Partial inhibition of the diphtheria bacilli does not stop the production of toxin. With present knowledge of this drug it can be recommended for use only in the treatment of carriers and of patients whose infection is persistent and who have not responded to adequate amounts of antitoxin.

105 North Eighth Street.

GALVANIC SKIN RESPONSE IN THE DIFFERENTIAL DIAGNOSIS OF DEAFNESS

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AND
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PRESENT clinical methods used in the differential diagnosis of organic from psychogenic deafness have proved adequate in the majority of cases. However, equivocal and unreliable responses are met with, particularly in psychotic or retarded patients or those with a "compensation fixation."

Methods of testing suspect cases of deafness are included in all standard textbooks. Priest [1] has outlined a satisfactory procedure for the uniform testing of patients with unilateral deafness. He has advocated the use of shadow curve audiograms, the Well's modification of the Stenger test, the Lombard reading test, the Marx test and several auxiliary aids.

The need for clearcut differentiation in the diagnosis and separation of organic from psychogenic deafness is apparent. Since positive results are not always possible with present established tests, the following objective method of testing was utilized. This method is applicable only to those professing or manifesting total unilateral or binaural deafness.

The galvanic skin response (GSR) was used by Redlich,[2] on the suggestion of Mays, in the differential diagnosis of organic from hysterical anesthesia. The galvanic skin response was chosen by him, as an objective method, because "a GSR cannot be elicited if the sensory pathway of the galvanic skin reflex is interrupted by a complete anatomical or physiological disruption of the peripheral nerve." The electroencephalograph proved a suitable instrument to record "the bioelectric changes accompanying sweat gland and vascular activities characteristic of a normally functioning sympathetic system"—i. e., the galvanic skin response (GSR).

1. Priest, R. E.: Tests for Unilateral Deafness, Arch. Otolaryng. **42**:138 (Aug.) 1945.

2. Redlich, F. C.: Organic and Hysterical Anesthesia: A Method of Differential Diagnosis with the Aid of the Galvanic Skin Response, Am. J. Psychiat. **102**:138 (Nov.) 1945.

This response to a variety of stimuli, including tactile, visual, auditory and psychic, has been reported by Landis.[3]

Slow waves or sways with a frequency of ¼ per second were noted in the electroencephalogram and related to local changes in the activity of the vegetative nervous system in the skin by earlier investigators. Gibbs and Gibbs [4] and others have also pointed out this phenomenon as a source of artefact, particularly in the frontal leads of electroencephalographic tracings.

We found the conjunctive use of an electroencephalograph, a standard audiometer and tuning forks satisfactory in eliciting the galvanic skin response from normal ears. With this established, the method, with modifications, became applicable to patients with unilateral or binaural deafness.

The galvanic cochlear reaction (Spiegel [5]) was not considered a satisfactory test because of its dependence on subjective responses.

METHOD

A preliminary study on normal controls was done to determine the potentialities of the method. A standard audiometer (Maico Model D-5) was used as one source of controlled sound. The electroencephalograph for recording the galvanic skin reaction was a Grass Model II, as suggested by Redlich.[2] During the test the subjects were recumbent in a properly shielded room. All possible extraneous noises and adventitious electrical disturbances were eliminated. Hand signals were used between the administrator of stimuli and the technician. Stimuli were applied only when there were no spurious deflections of the base line.

The bioelectric potentials were obtained from standard electroencephalographic solder electrodes applied over saline electrode paste and affixed with adhesive tape to the skin of the palm and forearm. Push-pull recording was used. The attenuator, set at 8, gave a calibration signal of 100 microvolts, equal to a 3 mm. deflection of the pen. The low frequency filter was set on medium (M) as in the usual electroencephalograph recording and the high frequency filter on four (4) to delete muscle potentials. Responses to various types of sensory, emotional and psychic stimuli were elicited. The latency between the stimulus and the response was from one to three seconds, the response consisting of a slow high voltage diphasic wave.

3. Landis, C.: Psychology and the Psychogalvanic Reflex, Psychol. Rev. **37**:381 (Sept.) 1930. Landis, C., and Forbes, T. W.: Investigation of Methods of Measurement of Electrical Phenomena of Skin, Psychiatric Quart. **7**:107 (Jan.) 1933.

4. Gibbs, F. A., and Gibbs, E. L.: Atlas of Electroencephalography, Cambridge, Mass., Lew A. Cummings Company, 1941, p. 192.

5. Spiegel, E. A., and Sommer, I.: Neurology of the Eye, Ear, Nose and Throat, New York, Grune & Stratton, Inc., 1944, p. 36.

The best galvanic skin reflexes were obtained with a cushioned air conduction receiver at tonal frequencies of 2048 and 1024, with the attenuator above 60 decibels. At maximum levels of intensity, the resultant waves showed greater amplitude. Below the 50 decibel setting poor responses were obtained. Tonal frequencies above 2048 and below 128 gave feeble galvanic skin reflexes.

The initial response to a single auditory stimulus was usually maximal. Subsequent galvanic skin reactions obtained on repeated successive stimulations showed gradual decrements. After an interval of rest, a maximal response was elicited.

This may be an evidence of fatigue phenomena, as noted by Spiegel [6] that a tuning fork declining in tone and no longer heard if removed from the ear is heard again, seconds later, when replaced. This intermittent or fractional perception of sound is pronounced in neurotic or hysterical persons, according to Hammerschlag.[7]

Matched air conduction receivers for binaural testing were unsuitable since they set up a 60 cycle type of interference which obscured the galvanic skin reaction tracings unless they were shielded.

Tuning forks (particularly C512 and C256) created good galvanic skin reactions. The spoken voice was also a satisfactory stimulant.

The patient was first given a complete physical, neurologic and psychiatric examination including the electroencephalogram, with indicated roentgenologic and laboratory studies. Thorough otolaryngic examination was done with the inclusion of vestibular tests (caloric) and sequent audiograms. On completion of all other tests, the patient was subjected to aural stimulation to obtain galvanic skin reactions with the aid of the electroencephalograph. The patient reclined on a bed with his eyes closed. The room lights were kept off. An air conduction receiver was embedded into a pillow against one ear. A masking noise was delivered to this ear. The opposite test ear was then subjected to varied sound stimuli.

The amplitude of the galvanic skin reactions differed in different patients, which may reflect variations in sweat gland, vascular or sympathetic activity.

REPORT OF CASES

The following illustrative cases give a representation of the results obtained.

Chart 1 shows the galvanic skin responses obtained on aural stimulation of a normal test subject.

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6. Spiegel and Sommer,[5] p. 26.

7. Hammerschlag, cited by Ballenger, W. L., and Ballenger, H. C.: Diseases of the Nose, Throat and Ear, Philadelphia, Lea & Febiger, 1943, p. 808.

CASE 1.—A. D., aged 32, a soldier, was injured in a civilian automobile accident in November 1945. He incurred multiple injuries, including a cerebral concussion and a linear fracture through the right frontal, sphenoid and temporal bones. He was unconscious for thirty-two days.

Four months later, he manifested memory defects, confusion and disorientation. He had complete deafness of the right ear and loss of vestibular function.

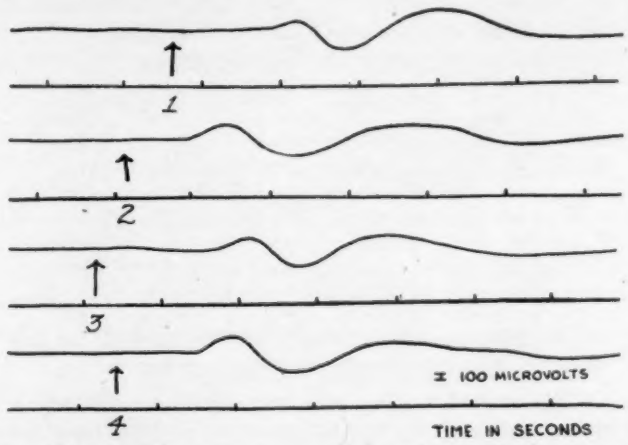

Chart 1.—Galvanic skin response recorded with the Grass electroencephalograph. Normal subject: *1*, response to tuning fork C256 to left ear; right ear masked. *2*, response to tuning fork C512 to right ear; left ear masked. *3*, response to spoken voice to right ear; left ear masked. *4*, response to spoken voice to left ear; right ear masked.

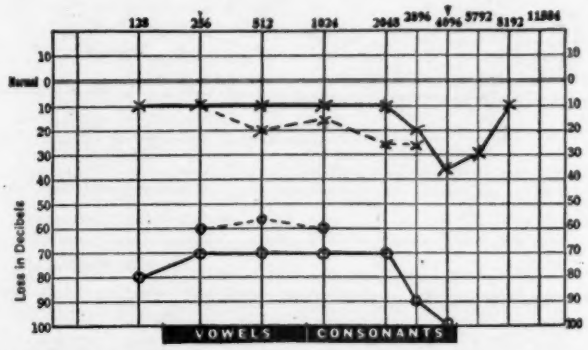

Chart 2 (case 1).—Audiogram showing total deafness on the right side, with shadow curve elicited.

In this and subsequent audiograms, the numbers at the top represent tonal frequencies; those at the left, decibels. The left ear curve is represented by crosses; the right, by circles. The dotted line indicates bone conduction; the solid line, air conduction.

The tympanic membranes were normal; the Weber test was lateralized to the left; the Rinne test was negative on the right and positive on the left side. Hearing for whispered voice was: right, 0/15; left, 15/15. An audiogram (chart 2) revealed a right shadow curve with complete loss of bone conduction on the same

side. The Stenger test (Well's modification), Lombard's test and the Marx test revealed no inconsistencies or evidence of residual hearing in the right ear.

Galvanic skin testing was then performed. This patient served as a further control in checking the validity of the method, since he had complete unilateral organic deafness. Normal galvanic skin reactions (chart 3) were obtained from his good, left, ear, while the right deaf ear was masked. With the masking noise

TABLE 1.—*Vestibular Test (Frenzel Caloric)*

	Latent Period	Duration of Nystagmus	Direction	Degree
	Cold Water, 60 F. (16 C.)			
Right	35 sec.	37 sec.	Left	1
Left	21 sec.	66 sec.	Right	3
	Hot Water, 115 F. (46 C.)			
Right	.....	.....	.....	
Left	18 sec.	60 sec.	Left	2

on his left ear, no galvanic skin reactions were obtained from the deaf ear. The tests were rechecked subsequently with consistent results.

CASE 2.—J. W., aged 28, a soldier, was sent into the hospital from a Separation Center. He was awaiting discharge but complained of great depression, unilateral deafness, tinnitus, insomnia, headaches and dizziness. He related several fainting attacks.

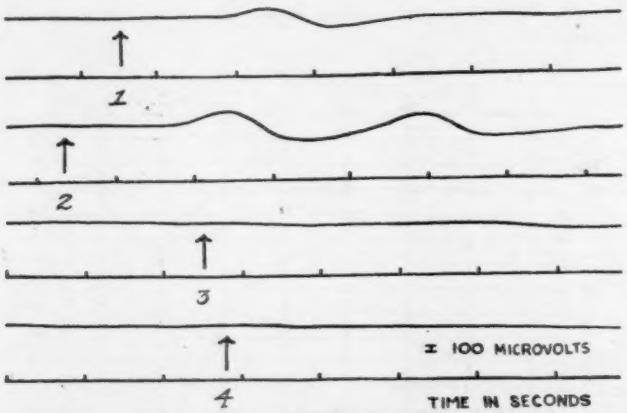

Chart 3 (case 1).—Galvanic skin responses recorded with the Grass electroencephalograph. Diagnosis: unilateral organic deafness, right, caused by fracture of the skull. *1*, response to tuning fork C512 to left ear; right ear masked. *2*, response to spoken voice to left ear; right ear masked. *3*, absence of response to tuning fork to right ear; left ear masked. *4*, absence of response to spoken voice to right ear; left ear masked.

His history revealed an episode of unconsciousness in November 1944, while he was in a combat zone, when he was struck by a falling tree.

He expressed suicidal ideas and had guilt feelings. His physical and neurologic examinations gave essentially negative results except for unilateral deafness. Roentgen studies of the skull showed no abnormality.

Otologic investigation showed normal tympanic membranes; the Weber test was lateralized to the right. The Rinne, the Schwabach, the Stenger (Well's modifications) and the Lombard test were unsatisfactory owing to the patient's retardation. Hearing for whispered voice was: right, 15/15; left, 0/15. An audiogram (chart 4) revealed no loss in the right ear and a professed loss of 89 per cent in the left. (Masking was used.) Bone conduction tests were unsatisfactory. Subsequent audiograms showed a total, claimed left deafness.

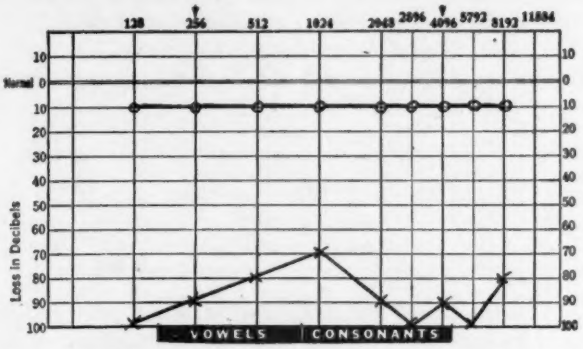

Chart 4 (case 2).—Audiogram showing professed left deafness. The patient later claimed total unilateral deafness. The bone conduction responses were unsatisfactory.

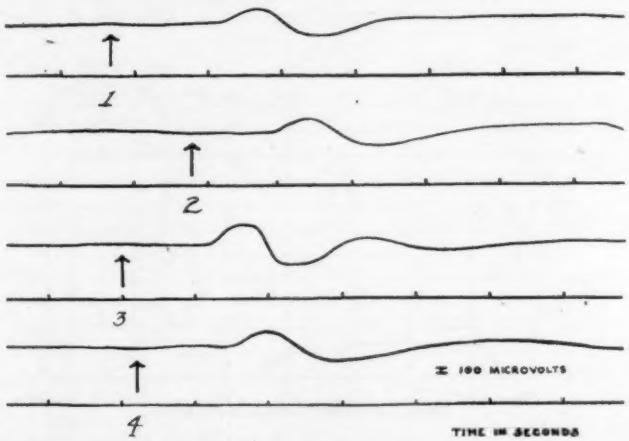

Chart 5 (case 2).—Galvanic skin responses recorded with the Grass electroencephalograph. Diagnosis: conversion hysteria manifested by deafness of the left side, tinnitus, headaches and dizziness. *1*, response to tuning fork C512 to claimed deaf left ear; right ear masked. *2*, response to spoken voice to claimed deaf left ear; right ear masked. *3*, response to tuning fork C512 to right ear; left ear masked. *4*, response to spoken voice to right ear; left ear masked.

Reexamination three months later, after he had received a series of electroshock treatments, showed no change in the otologic findings.

Galvanic skin reaction studies (chart 5) were performed. They showed normal responses (diphasic curves) from the professed deaf ear to tuning fork and spoken voice stimuli while the admittedly normal right ear was masked. The positive responses demonstrate the psychogenic nature of this patient's unilateral deafness.

CASE 3.—N. A., aged 35, an officer, presented a long, involved history of repeated Army hospitalization dating back three years.

In January 1943, while shaving one morning he became dizzy, fell down and struck the back of his head. His condition was subsequently diagnosed, in April 1943, as: arrhythmia; auricular fibrillation, paroxysmal; carotid sinus syndrome, mild, right, cause undetermined. His hearing then was: right 20/20; left 15/20, with a 1 per cent audiometric loss bilaterally. His audiometric curves showed a sharp loss above a tonal frequency of 2048. Caloric and vestibular tests were normal. He had no history of acoustic trauma or of otitis media.

TABLE 2.—*Vestibular Test (Caloric–Kobrak Minimal)*

	Latent Period	Duration of Nystagmus	Direction	Degree	Past Pointing	Falling
		Cold Water, 55 F. (13 C.)				
Right.....	36 sec.	71 sec.	Left	1	.....	Right
Left.....	44 sec.	86 sec.	Right	1	Right	Left

He was later sent overseas but complained of dizzy spells, fainting and moderate deafness. Subsequently he was evacuated to the Zone of Interior, with diagnoses of: deafness, perceptive, cause undetermined; hearing, 13/15 bilaterally; audiometric loss, right, 53 per cent; left, 44 per cent; ill defined condition of ears and of semicircular canals bilaterally, manifested by insensitivity to the caloric test, right worse than left; memory deficiency, postconcussion, moderate, and carotid sinus syndrome.

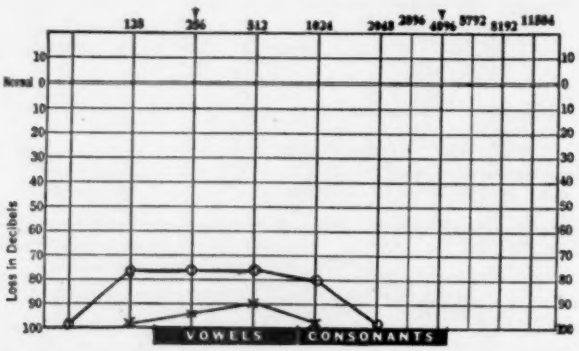

Chart 6 (case 3).—Audiogram of patient alleging total loss of serviceable hearing and no bone conduction.

At the receiving hospital his hearing was reported as: right, 2/15; left, 1/15. He was transferred to a hearing center. He then professed an audiometric loss of: right, 62 to 90 per cent; left, 92 to 99 per cent. Electroencephalograms showed no abnormalities. Stereoscopic roentgenograms of the skull showed no abnormalities. Studies made with the patient under the influence of pentothal in an effort to restore the hearing were unsuccessful. He was transferred to this hospital.

He repeated the history of progressive bilateral deafness and complained of forgetfulness, dizziness and "black-outs."

Physical examination gave negative results; neurologic studies showed weak muscular responses in the left arm and, in the Romberg position, leaning to the left but no falling.

Otologic investigation revealed normal canals and essentially normal tympanic membranes. Lateralization in the Weber test was to the right. The Rinne test was negative on the right and positive on the left. The eustachian tubes were patent bilaterally. With the Lombard test no elevation of the voice resulted. Hearing for whispered voice was 1/15 in both ears.

TABLE 3.—*Vestibular Test (Frenzel Caloric)*

	Latent Period	Duration of Nystagmus	Direction	Degree
	Cold Water, 60 F. (16 C.)			
Right	38 sec.	71 sec.	Left	3
Left	36 sec.	90 sec.	Right	3
	Hot Water, 115 F. (46 C.)			
Right	59 sec.	51 sec.	Right	1
Left	49 sec.	10 sec.	Left	1

Several weeks later, after psychiatric investigation, the patient was again examined. He professed an audiometric loss (chart 6) of: right, 91.5 per cent; left, 100 per cent. Repetition of caloric tests revealed activity bilaterally.

Examination was performed to obtained galvanic skin reactions. A masking noise was first used on his right ear and the left stimulated by tuning fork (C512)

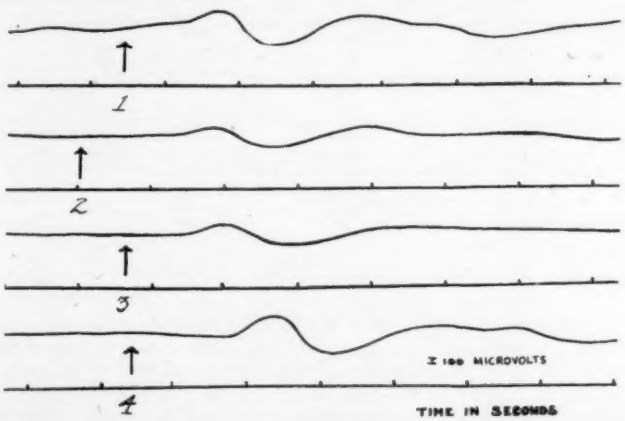

Chart 7 (case 3).—Galvanic skin responses recorded with the Grass electroencephalograph. Diagnosis: conversion hysteria manifested by bilateral deafness, dizziness and inability to concentrate. *1*, response to tuning fork C512 to left ear; right ear masked. *2*, response to spoken voice to left ear; right ear masked. *3*, response to tuning fork C512 to right ear; left ear masked. *4*, response to spoken voice to right ear; left ear masked.

and the spoken voice. He showed a definite response to these stimuli. The left ear was then masked and the right ear subjected to sound, with similar positive galvanic skin reactions (chart 7).

This confirmed the opinion given as the result of previous clinical examination that the patient had bilateral retention of hearing within the speech range. On completion of the tests he admitted that he heard some sounds. He was considered a candidate for further psychiatric treatment in view of his conversion reaction, which was severe and manifested by elaboration of hearing loss.

CASE 4.—J. P., a 28 year old soldier, applied for reenlistment. He showed sufficient findings to warrant more complete investigation.

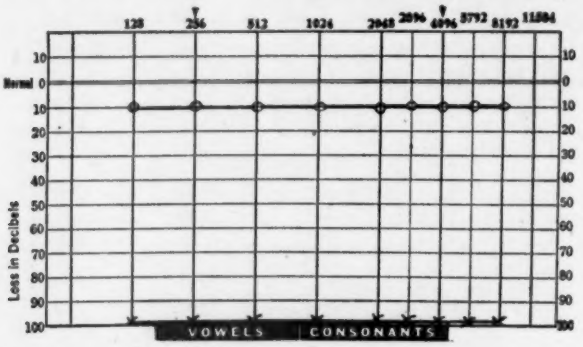

Chart 8 (case 4).—Audiogram of patient with unilateral organic deafness, who elaborated his symptoms and failed to give a shadow curve.

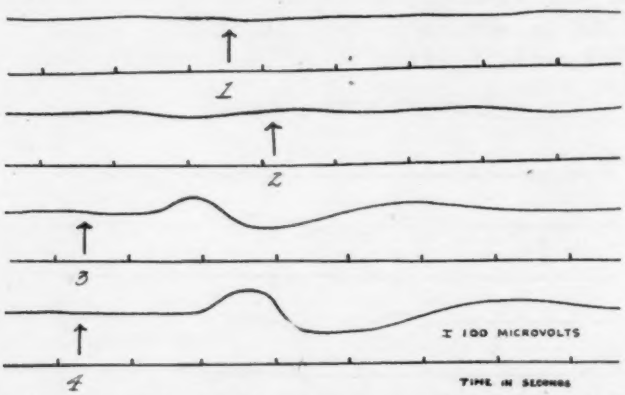

Chart 9 (case 4).—Galvanic skin responses recorded with the Grass electroencephalograph. Diagnosis: palsy of the left fifth, seventh and eighth cranial nerves caused by old acute syphilitic meningitis. *1*, absence of response to tuning fork C512 to left ear; right ear masked. *2*, absence of response to spoken voice to left ear; right ear masked. *3*, response to tuning fork C512 to right ear; left ear masked. *4*, response to spoken voice to right ear; left ear masked.

He was in good health until 1939, when he contracted syphilis. He received injections for six months and then stopped all treatment. About eight months later he had nausea, vomiting, headaches, dizziness and a staggering gait. He became suddenly deaf in his left ear; facial paralysis developed on the left side, and he noted visual loss on the left side. He resumed antisyphilitic therapy with definite improvement except for the deafness and the facial paralysis.

Subsequently, he was inducted into the Army and performed satisfactorily.

On neurologic examination he evidenced: hypesthesia over the first and second divisions of the left fifth nerve, complete peripheral palsy of the left seventh nerve and perceptive deafness on the left side. The Kahn test was negative. The spinal fluid pressure was normal; the Wassermann and colloidal gold tests were negative. The total serum protein was 20 mg. per hundred cubic centimeters. Roentgen studies of the skull with views of the petrous ridges revealed nothing abnormal.

Otologic examination showed normal-appearing tympanic membranes. The Weber test was lateralized to the right. The Rinne test was positive on the right and negative on the left. Hearing for whispered voice was: right, 15/15; left, 0/15. Results of the Stenger test (Well's modification) and the Lombard reading test confirmed the diagnosis of unilateral deafness. But on audiometric examination (chart 8) he showed no crossed perception. Despite careful instruction he would not admit a shadow curve of the contralateral normal ear.

Aural stimulation was performed to obtain galvanic skin responses (chart 9). No galvanic skin reactions were found on the left side; stimulation of the right ear gave responses indicative of an intact sensory pathway.

This patient, although informed that he was not suspect, refused to admit diagonal resonance from his good ear.

SUMMARY AND CONCLUSIONS

Present clinical methods for testing total unilateral or binaural deafness are usually adequate. The results, however, are often equivocal and unreliable in retarded, psychotic or compensation-minded patients.

An objective method, utilizing the galvanic skin response in differentiating organic from psychogenic deafness, is offered. The test is performed with the aid of an electroencephalograph, a source of sound and a masking device. Several illustrative cases, with graphic records, are presented.

This test when properly performed is conclusive and particularly suitable in evaluating claims of total unilateral or binaural deafness. It is applicable to other sensory disturbances, e. g., blindness.

280 MacArthur Boulevard, West; Oakland, Calif.

INDICATIONS FOR THE FENESTRATION OPERATION

HOWARD P. HOUSE, M.D.
LOS ANGELES

IN SELECTED cases of clinical otosclerosis the fenestration operation has proved of definite value in restoring practical, serviceable hearing.

It is generally accepted that any patient with a bilateral conductive type of hearing impairment who has intact ear drums and patent eustachian tubes and who does not exhibit other obvious pathologic condition of the ear may be considered as having clinical otosclerosis.

It is likewise generally accepted that patients with clinical otosclerosis who are not over 60 years of age and who are in good health are suitable for the fenestration operation, provided they have reasonably good function of the cochlear nerve.

The degree of function of the cochlear nerve is determined by both tuning fork and audiometric testing. If the patient with clinical otosclerosis has loss of serviceable hearing, the duration of bone conduction over air conduction with a 1024 fork is in direct proportion to the difference between air conduction and the degree of cochlear nerve function present. This simple procedure serves as a ready means of confirming the audiometric findings.

Candidates for the fenestration operation may be classified as ideal, borderline and nonsuitable, depending on the amount of nerve function present in the speech frequencies.

INDICATIONS

GROUP 1. *Ideal Candidates for Fenestration.*—In this group, the V. Mueller magnesium alloy 1024 tuning fork is heard ten seconds or longer by bone conduction than by air conduction.

The nerve loss by audiometry is 10 decibels or less for the speech frequencies.

GROUP 2. *Borderline Candidates for Fenestration.*—In this group the 1024 fork is heard five to ten seconds longer by bone conduction than by air conduction.

The nerve loss by audiometry does not exceed 20 decibels for two speech frequencies and is not more than 30 decibels for the remaining 2048 frequency.

From the Department of Otolaryngology, University of Southern California School of Medicine.

Read before the Western Section of the American Laryngological, Rhinological and Otological Society Inc., Los Angeles, Jan. 26, 1946.

GROUP 3. *Candidates Not Suitable for Fenestration.*—In this group the 1024 fork is heard longer by air conduction than by bone conduction.

The nerve loss by audiometry is more than 20 decibels for two speech frequencies or more than 30 decibels for the remaining 2048 frequency.

If the curve of nerve function continues downward in the frequencies above 2048, the prognosis does not seem as good as it does in those cases in which the curve continues at the same level in the higher frequencies.

Using the aforementioned indications, I have performed a total of 250 fenestration operations by the Lempert nov-ovalis technic. Of the 250 patients, 111 have now been observed for more than six postoperative months, and the hearing level obtained will in all probability remain stationary. All results are based on subjective restoration of practical conversational hearing as well as on audiometric levels. In order to determine the presence of practical conversational hearing,

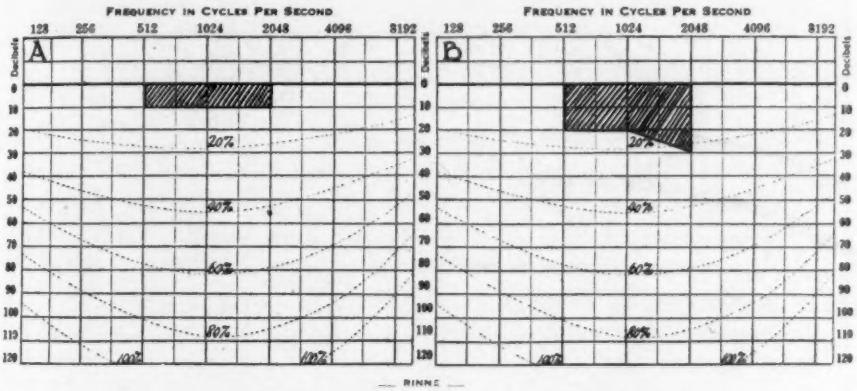

Chart 1.—Candidates for fenestration classified by the degree of cochlear nerve function present: *A*, ideal; *B*, borderline. The ideal candidate shows by audiometry not more than 10 decibels of loss for the speech frequencies. The borderline candidate shows a loss not exceeding 20 decibels for two speech frequencies and not exceeding 30 decibels for the remaining one.

At the present time there is much to be desired in determining accurately the degree of nerve function present. Audiometric results should coincide with the tuning fork responses in these cases. Careful repeated testing both with tuning forks and with the audiometer—allowing for some latitude—is necessary before a patient can be properly classified as ideal, borderline or nonsuitable for fenestration.

the following questionnaire is mailed to the patient six months, twelve months and twenty-four months after the surgical intervention. This is of value in predicting the patient's chances of obtaining serviceable hearing following his surgical treatment.

In comparing the patient's questionnaire with his audiograms, one finds that the 30 decibel level in the speech range is fairly consistent with practical hearing. Occasionally, however, a patient will have more than a 30 decibel loss in the speech range and maintain he has practical

hearing. Likewise, occasionally a patient will have less than a 30 decibel loss in the speech range and state that he does not have practical hearing. I would much prefer a satisfied patient to a satisfactory audiogram. No doubt, speech audiometry will aid in understanding these apparent discrepancies.

In chart 3 statistical data are presented to emphasize the importance of cochlear nerve function in the selection of patients for the fenestration operation.

RESULTS

GROUP 1. *Candidates Ideal for Fenestration.*—A total of 49 patients are classified in this ideal group. Of these 49 patients, 39, or 79 per cent,

Dear

It has been———months since your hearing operation. Will you please complete the following questionnaire and return it promptly for my records?

Question	Yes	No
1. Do you have practical useful hearing?.....	☐	☐
2. Is your hearing improved?.....	☐	☐
3. Is your hearing unchanged?.....	☐	☐
4. Is your hearing worse?.....	☐	☐
5. Did you wear an aid before operation?.....	☐	☐
6. Do you wear an aid now?.....	☐	☐
7. Do you feel the need of an aid?.....	☐	☐
8. Did you have head noises before operation?.....	☐	☐

9. Are your head noises now (gone ☐; less ☐; worse ☐)?

10. Do you have ear discharge?.... No ☐ Slight ☐ Marked ☐

11. Do you have dizziness? No ☐ Slight ☐ Marked ☐

Other comments:

Chart 2.—Questionnaire answered by patients at six month, twelve month and twenty-four month intervals.

have maintained practical, serviceable hearing longer than six months. The average preoperative level of this group was 53 decibels, representing a hearing loss of 42.4 per cent by the American Medical Association standard. The average postoperative level was 24.3 decibels, or 18.4 per cent. This represents a gain of 28.7 decibels, or 22.9 per cent.

Ten patients, representing 20 per cent of the total, failed to obtain permanent serviceable hearing. Of these, 4, representing 8 per cent of the total, have maintained an improvement, but the gain is not sufficient to provide serviceable hearing. The hearing level in 2, representing 4 per cent of the total, was not altered following surgical treatment, even though the fistula test remained strongly positive. The cause of this

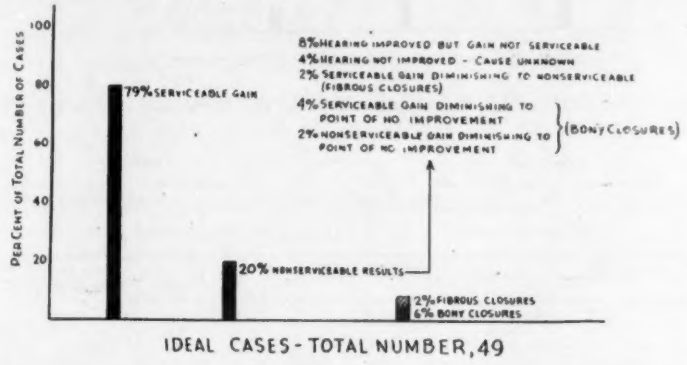
PER CENT OF TOTAL NUMBER OF CASES
100
80
60
40
20
79% SERVICEABLE GAIN
20% NONSERVICEABLE RESULTS
2% FIBROUS CLOSURES
6% BONY CLOSURES
8% HEARING IMPROVED BUT GAIN NOT SERVICEABLE
4% HEARING NOT IMPROVED - CAUSE UNKNOWN
2% SERVICEABLE GAIN DIMINISHING TO NONSERVICEABLE (FIBROUS CLOSURES)
4% SERVICEABLE GAIN DIMINISHING TO POINT OF NO IMPROVEMENT
2% NONSERVICEABLE GAIN DIMINISHING TO POINT OF NO IMPROVEMENT
(BONY CLOSURES)
IDEAL CASES - TOTAL NUMBER, 49

Chart 3.—Summary of the results in 49 ideal candidates in the series.

phenomenon is not clearly understood. Four patients, representing 8 per cent, improved following the operation but later returned to their preoperative hearing level because of closure of the fenestra.

GROUP 2. *Borderline Candidates.*—A total of 62 patients are classified in this borderline group. Of these 62 patients, 34, or 55 per cent,

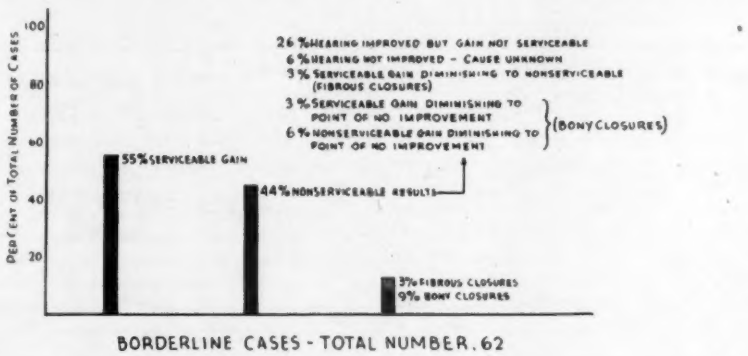
PER CENT OF TOTAL NUMBER OF CASES
100
80
60
40
20
55% SERVICEABLE GAIN
44% NONSERVICEABLE RESULTS
3% FIBROUS CLOSURES
9% BONY CLOSURES
26 % HEARING IMPROVED BUT GAIN NOT SERVICEABLE
6 % HEARING NOT IMPROVED - CAUSE UNKNOWN
3 % SERVICEABLE GAIN DIMINISHING TO NONSERVICEABLE (FIBROUS CLOSURES)
3 % SERVICEABLE GAIN DIMINISHING TO POINT OF NO IMPROVEMENT
6 % NONSERVICEABLE GAIN DIMINISHING TO POINT OF NO IMPROVEMENT
(BONY CLOSURES)
BORDERLINE CASES - TOTAL NUMBER, 62

Chart 4.—Summary of the results in 62 borderline candidates in the series.

have maintained serviceable hearing longer than six months. The average preoperative level of this group was 57.5 decibels, representing a hearing loss of 46 per cent. The average postoperative level was 28 decibels, or 24.8 per cent. This represents a gain of 29.5 decibels, or 23.6 per cent.

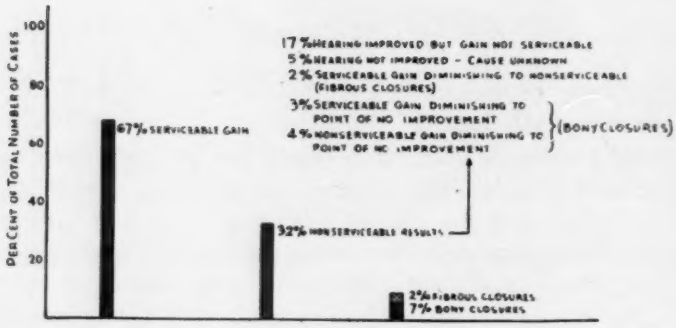
PER CENT OF TOTAL NUMBER OF CASES
100
80
60
40
20
67% SERVICEABLE GAIN
32% NONSERVICEABLE RESULTS
2% FIBROUS CLOSURES
7% BONY CLOSURES
17% HEARING IMPROVED BUT GAIN NOT SERVICEABLE
5% HEARING NOT IMPROVED - CAUSE UNKNOWN
2% SERVICEABLE GAIN DIMINISHING TO NONSERVICEABLE (FIBROUS CLOSURES)
3% SERVICEABLE GAIN DIMINISHING TO POINT OF NO IMPROVEMENT
4% NONSERVICEABLE GAIN DIMINISHING TO POINT OF NO IMPROVEMENT
(BONY CLOSURES)
IDEAL AND BORDERLINE CASES - TOTAL NUMBER, 111

Chart 5.—Summary of the results in both the ideal and the borderline cases (111) in the series.

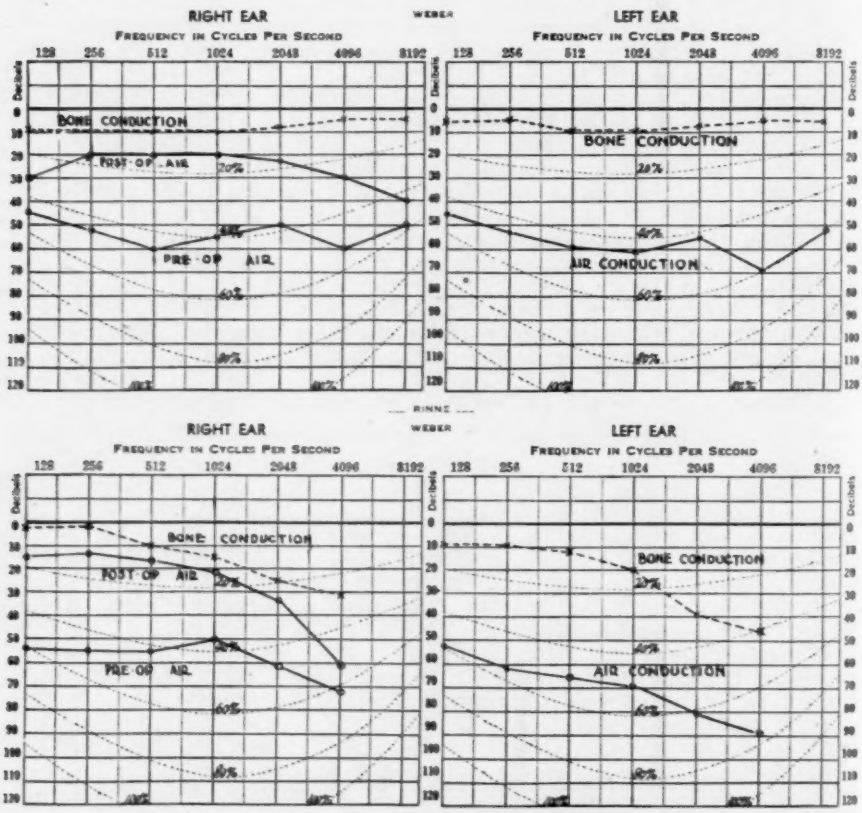

Chart 6.—Above: Audiograms of an ideal candidate (G. H.) whose hearing was improved to the serviceable level. This candidate was classified as ideal since he heard the 1024 fork fifteen seconds longer by bone conduction than by air conduction and had less than 10 decibel bone loss by audiometry in the speech frequencies.

Below: Audiograms of a borderline candidate (F. R.) whose hearing was improved to the serviceable level. This candidate was classified as borderline since he heard the 1024 fork seven seconds longer by bone conduction than by air conduction and had less than a 20 decibel bone loss at 512 and 1024 and less than a 30 decibel loss at 2048 by audiometry.

Air conduction is indicated by a heavy unbroken line; bone conduction by a heavy broken line. The percentage of hearing loss is indicated by the curved dotted lines. It is approximately equal to the average reading in decibels at 512, 1024 and 2048 multiplied by 0.8.

Twenty-eight patients, representing 44 per cent of the total, failed to obtain permanent serviceable hearing. Of these, 16, representing 26 per cent of the total, have maintained an improvement, but the gain was not sufficient to provide serviceable hearing. The hearing level in 4 patients, representing 6 per cent of the total, was not altered following the operation. In 8 patients, representing 12 per cent of the total, closure of the fenestra occurred.

A comparison of the ideal and borderline groups reveals that the ideal candidate has a 24 per cent better chance of obtaining permanent, serviceable hearing than has the candidate who is classified in the borderline group. This is of value in predicting the patient's chances of obtaining serviceable hearing.

GROUP 3. *Patients Not Suitable for Fenestration.*—The fenestration operation may be performed occasionally on patients whose tuning fork and audiometric test placed their nerve function just below the lower limit for the borderline group.

For young persons who are encountering a rapid loss of nerve function, the operation may be justified as an attempt to prevent further loss of nerve function as well as to improve their hearing.

Likewise, patients with otosclerosis whose nerve function is just below the lower limit for the borderline group and who are suffering from considerable tinnitus may at times be benefited by fenestration.

I have had occasion to operate on 6 patients classified in this group, with the following results: In 2 patients, whose nerve function was just below the lower limit for the borderline group, there was restoration of practical, serviceable hearing. Three patients showed an audiometric gain but did not reach the serviceable level. One patient, whose loss of nerve function averaged 35 decibels in the speech frequencies, was operated on in an attempt to alleviate his marked unilateral tinnitus. This patient received no audiometric improvement, but tinnitus was eliminated in the surgically treated ear. This has allowed him to use his hearing aid with much greater efficiency, for which he is grateful.

COMMENT

In this series of 111 persons who have been observed for more than six months since they underwent the fenestration operation for otosclerosis there were no serious complications. Three felt their hearing was worse after the operation, but audiometric studies revealed both the bone and the air conduction curve to be at the preoperative level.

SUMMARY

A simple classification of fenestration candidates based on cochlear nerve function has been presented.

Seventy-nine per cent of the ideal candidates and 55 per cent of the borderline candidates, giving an average of 66 per cent, have maintained practical, serviceable hearing over six months.

Eighty-four per cent of the candidates operated on have maintained an audiometric improvement over six months.

The importance of cochlear nerve function in the selection of patients for the fenestration operation cannot be overemphasized.

CORRELATIONS OF HEARING TESTS

MAJOR BARNARD C. TROWBRIDGE
MEDICAL CORPS, ARMY OF THE UNITED STATES

IN VIEW of the vast amount of evidence accumulated during the recent war years, a revision of the interpretation of the results of the various methods employed in the testing of hearing is apparently indicated. Previous efforts to correlate the results obtained from the commonly prescribed whispered voice test, the tuning fork test and the audiometric test have led to divergent opinions. It can be clearly stated that available evidence strongly points to the need for a better understanding of the purpose of the tests and of the significance of the results. In this study the results of the three tests will be considered and their correlations discussed.

The problem of hearing assumes a position of major importance in civilian industry since our recent military experiences have reemphasized the need for definitive selection of those who are to be associated with a noisy environment. The evaluation of hearing potentials must be considered in regard to the person with so-called normal hearing as well as in regard to the person with defective hearing. Factors such as premature fatiguing, deficiency of hearing for discrete high tones and subnormally induced tinnitus indicate an unstable and susceptible mechanism of hearing, even though the acuity of hearing appears to be normal.

Chamberlain [1] discussed the effect of noise on aural fatigue and recovery from the industrial point of view. He pointed out that the ears of one man may be definitely more susceptible than those of another to the same fatiguing sound. Hence, the importance of precision testing cannot be overlooked in the evaluation of the hearing status.

From the Ear, Nose and Throat Section of the Surgical Service, Army Air Force Regional Hospital, Scott Field, Ill.

The opinions contained herein are the personal ones of the writer and are not to be construed as official or reflecting the views of the War Department.

This article was submitted as a thesis to the Faculty of the Graduate School of Medicine of the University of Pennsylvania in partial fulfilment of the requirements for the degree of Master of Medical Science (M.Sc. [Med.]) for graduate work in otolaryngology.

1. Chamberlain, D.: Occupational Deafness: Audiometric Observations of Aural Fatigue and Recovery, Arch. Otolaryng. **35**:595-602 (April) 1942.

The analysis contained herein is based on the examination of 24,740 patients, of whom 1,184 were tested by the individual audiometric method. All the studies of hearing were confined to patients with quiescent aural conditions. The opportunity to make this study was afforded by daily contact with students in radio operator training school over an eighteen month period. These patients were of particular interest in that the majority of their complaints arose from their inability to continue (code) training successfully due to defective acoustic perception. It is of interest to note that of 108,601 patient visits to the ear, nose and throat clinic, 32,830 were due to aural complaints, some directly and some indirectly concerned with hearing difficulties.

The majority of the aural conditions were acute in nature and only temporarily interfered with radio training. However, the frequency with which hearing complaints were not associated with active otitic infections was sufficiently impressive to warrant further study inasmuch as the routinely prescribed whispered voice test failed to reveal suspected hearing defects in many cases.

The whispered voice tests were standardized as nearly as possible by having the tests performed by myself and one trained medical technician. The whispered voice test was employed at the 15 foot (4.5 meter) distance. The whisper was made by the residual air method. All the tests were performed in the same room, in which the maximum noise threshold did not exceed 15 decibels. The noise threshold was and should be kept at a minimum in order to obtain acceptable results with the whispered voice test. Noise in the average clinic or city office is sufficient to shift the threshold of hearing 20 or 30 decibels without awareness of the examiner. Hence, a speech test made in such an environment would not differentiate between ears that are normal and those having a 30 decibel loss in hearing.[2] While some argue against definite conclusions being made from tests not performed in a soundproof environment, the situation nevertheless permits a comparison of results obtained under the testing conditions normally available in the majority of military establishments and in civilian offices.

In addition to the whispered voice test, audiometric analysis and tuning fork studies were made. These studies were made in the same room and under the same conditions as the whispered voice test. The watch, coin click and low conversational voice tests were discarded since the basic conditions involved in these tests present too many variable features not susceptible to reasonable standardization.

The accompanying table shows, respectively, the initials and the age of the patient, the audiographic type of the hearing deficiency, the result of the whispered voice test, the audiographic percentage loss for

2. Fletcher, H.: Speech and Hearing, New York, D. Van Nostrand Company, Inc., 1936, p. 203.

the conversational range and the entire perceptional range (128 to 8192 cycles per second), the objective findings, the past history of otitis media, the exposure to severe noise and the presence of tinnitus. The percentage loss of hearing was calculated according to the method of weighted loss for each frequency as devised by the Committee on Standards of the American Medical Association.

In order to achieve as accurate a correlation as possible between the result of the whispered voice test and the corresponding audiographic findings, the comparison is limited to the mixed type hearing defect. It may be noticed in the table that the audiographic percentage loss over the conversational range correlates fairly well with the entire range loss

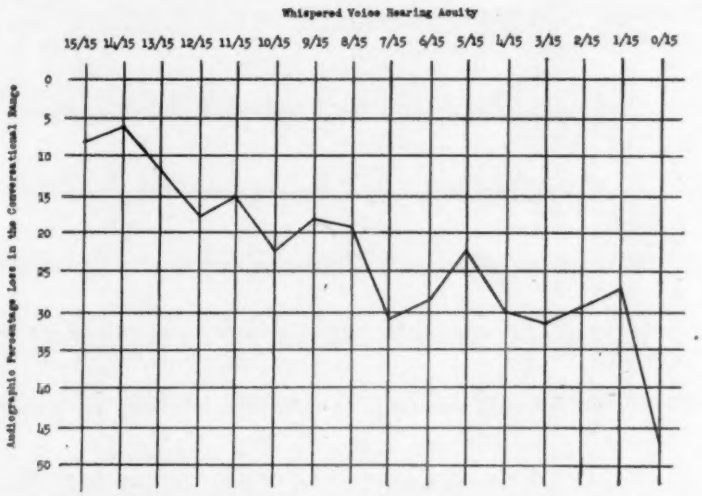

Chart 1.—Correlation of the loss established by whispered voice test and the audiographic percentage loss in the conversational range.

only in mixed type hearing deficiency. The character of this type of hearing deficiency makes the correlation obvious. Chart 1 shows the correlation between the loss found by the whispered voice test and the percentage loss over the conversational range in 215 cases with mixed type hearing deficiencies.

It can be seen even with the type of hearing deficiency that lends itself optimally to correlation studies that the correlation between the results of the two tests is poor. In calculating the average percentage loss for chart 1, variations such as 6 to 30 per cent at 12/15, 6 to 46 per cent at 1/15, 7 to 30 per cent at 8/15, 9 to 42 per cent at 5/15 and 13 to 48 per cent at 3/15 occurred. Results of this nature certainly preclude any justifiable conclusions being made from the whispered voice test alone.

	Initials	Age	Audiographic Type	Audiographic Loss, %						Objective Findings in Drum Membrane				Past History of Otitis Media	Exposure to Severe Noise	Tinnitus
				Whispered Voice		Conversational Range		Entire Range								
				Right	Left	Right	Left	Right	Left	Lack of Luster	Retraction	Thickening	Scars			
1	F. B. W.	30	Low	15/15	13/15	0	13	0	9	L	L	L	..	..	+	L
2	H. G. L.	25	Low	14/15	14/15	29	16	21	11	RL	RL	..	..	..	+	RL
3	C. B. S.	26	Mixed	0/15	1/15	35	34	36	37	RL	RL	..	RL			
4	J. E. B.	18	Mixed	6/15	9/15	10	14	18	18	RL	RL					
5	A. W. D.	22	Mixed	10/15	10/15	46	48	47	49	RL	RL	..	..	..	+	RL
6	A. G. E.	32	Mixed	6/15	6/15	60	57	70	66	RL	RL	RL	RL	RL		
7	M. G.	34	Mixed	1/15	2/15	18	16	18	21	RL	RL					
8	P. M. H.	26	Mixed	15/15	8/15	15	22	15	26	RL	RL	RL	..	..	..	RL
9	T. A.	33	Mixed	13/15	8/15	9	23	25	35	RL	RL					
10	W. J. B.	23	Mixed	15/15	15/15	5	0	12	5	R	R	R	..	R		
11	S. T. B.	38	Mixed	15/15	1/15	8	29	20	37	RL	RL					
12	F. G. B.	27	Mixed	1/15	1/15	17	23	25	29	RL	RL					
13	H. H. G.	30	Mixed	15/15	13/15	11	13	22	19	RL	RL	..	..	..	+	RL
14	G. J. G.	24	Mixed	12/15	15/15	19	3	20	11	RL	RL	..	..	..	+	R
15	C. F. H.	39	Mixed	8/15	4/15	30	30	39	39	RL	RL					
16	A. J. O.	25	Mixed	0/15	2/15	46	31	54	37	RL	RL	..	..	..	+	RL
17	C. L. P.	28	Mixed	15/15	1/15	0	62	5	62	L	L	L	L	L		
18	R. J. K.	29	Mixed	6/15	4/15	16	16	23	24	RL	RL					
19	O. W. M.	25	Mixed	3/15	15/15	38	0	41	4	R	R	R	R	R		
20	C. M.	24	Mixed	7/15	10/15	75	58	68	53	RL	RL					
21	J. R. M.	24	Mixed	15/15	15/15	0	13	5	19	RL	RL					
22	T. J. M.	29	Mixed	3/15	15/15	47	0	54	7	R	R					
23	V. A. S.	24	Mixed	3/15	4/15	25	20	30	28	RL	RL					
24	J. P. S.	22	Mixed	15/15	0/15	0	46	[illegible]	50	L	L					
25	H. B. S.	25	Mixed	15/15	15/15	14	0	18	2	RL	RL					
26	O. W. B.	34	Mixed	8/15	7/15	14	22	22	30	RL	RL					
27	G. W. B.	27	Mixed	15/15	12/15	0	45	0	82	L	L					
28	K. D. G.	20	Mixed	15/15	15/15	16	7	16	11	RL	RL					
29	T. O. H.	33	Mixed	5/15	10/15	23	14	31	25	RL	RL					
30	G. W. A.	21	Mixed	8/15	15/15	21	0	29	0	R	R	..	..	R	..	R
31	J. H. D.	25	Mixed	15/15	10/15	7	15	20	24	RL	RL					
32	K. W. H.	21	Mixed	4/15	4/15	15	21	23	28	RL	RL					
33	J. N. J.	25	Mixed	0/15	15/15	55	0	67	9	R	R					
34	J. N. J.	41	Mixed	3/15	15/15	17	3	27	9	R	R	..	..	R		
35	J. L. L.	19	Mixed	0/15	15/15	64	6	70	16	R	R	..	..	R		
36	W. M. L.	38	Mixed	7/15	7/15	10	40	23	36	RL	RL					
37	D. A. R.	21	Mixed	5/15	13/15	19	11	25	22	RL	RL	..	..	..	+	RL
38	W. F. R.	24	Mixed	15/15	0/15	0	44	5	53	RL	RL	RL	RL	RL		

39	F. B.	30	Mixed	0/15	15/15	65	0	72	2	RL	R	R	R	R		
40	E. L. J.	25	Mixed	15/15	15/15	4	7	4	9	RL						
41	H. S.	34	Mixed	15/15	12/15	0	29	20	32	RL	..	..	..	..	..	RL
42	A. S.	18	Mixed	1/15	0/15	20	30	33	40	RL						
43	R. A. S.	36	Mixed	12/15	15/15	18	3	22	11	R	R	..	..	R		
44	J. N. S.	26	Mixed	10/15	13/15	23	17	25	19	RL	..					
45	G. W. T.	28	Mixed	15/15	1/15	0	37	11	42	RL	RL	RL				
46	H. J. Z.	32	Mixed	13/15	11/15	21	15	28	16	RL	RL	RL	RL	RL		
47	N. I. A.	32	Mixed	15/15	3/15	0	27	1	27	L	L	..	..	L		
48	W. A.	22	Mixed	9/15	4/15	38	49	38	49	RL	RL					
49	D. I. A.	24	Mixed	15/15	4/15	0	50	0	51	RL	RL					
50	J. A. B.	20	Mixed	0/15	15/15	45	0	53	1	R	R	R	..	R		
51	E. C. B.	26	Mixed	15/15	0/15	0	44	3	37	L	L					
52	J. B.	16	Mixed	15/15	3/15	0	36	0	47	L	L					
53	L. W. B.	37	Mixed	15/15	10/15	15	27	20	41	RL	RL					
54	G. G. B.	43	Mixed	1/15	0/15	41	44	44	52	RL	..	..	..	..	+	
55	A. J. B.	68	Mixed	0/15	0/15	43	35	48	39	RL						
56	H. L. B.	23	Mixed	1/15	0/15	29	38	35	40	RL						
57	J. B. C.	21	Mixed	15/15	0/15	0	46	1	48	L	L					
58	J. P. C.	35	Mixed	6/15	8/15	13	7	25	18	RL	RL					
59	O. B. C.	32	Mixed	10/15	15/15	17	0	17	9	R						
60	J. W. C.	25	Mixed	0/15	15/15	50	0	55	3	R	..	..	..	..	+	
61	D. G.	36	Mixed	13/15	10/15	7	10	11	12	RL	RL					
62	O. J. C.	21	Mixed	3/15	5/15	13	12	21	17	RL	RL					
63	J. P. S.	18	Mixed	15/15	3/15	0	48	0	49	L	L	L	L	L		
64	D. K.	23	Mixed	15/15	15/15	4	11	12	23	RL	..	..	..	..	..	RL
65	M. G.	34	Mixed	1/15	1/15	17	24	21	25	RL	RL					
66	D. A. K.	18	Mixed	1/15	15/15	36	0	41	5	R	R					
67	H. G. L.	25	Mixed	15/15	15/15	14	28	11	20	RL	RL					
68	O. C. N.	19	Mixed	15/15	8/15	0	16	9	26	L	L					
69	J. A. L.	23	Mixed	15/15	15/15	15	0	24	1	R	R	..	..	..	+	R
70	C. M. N.	25	Mixed	8/15	15/15	12	0	15	5	RL	RL	RL	RL	RL	+	
71	P. Z. S.	25	Mixed	15/15	15/15	7	5	9	10	RL	RL					
72	R. L. W.	58	Mixed	12/15	1/15	3	19	17	37	RL	RL	RL	RL	L		
73	M. P. D.	26	Mixed	15/15	15/15	3	3	7	7	RL	RL	RL	..	RL	+	RL
74	W. J. O.	27	Mixed	15/15	0/15	4	55	8	60	L						
75	G. T. E.	36	Mixed	0/15	9/15	28	18	44	20	RL	RL	RL	L	R		
76	O. V. E.	26	Mixed	15/15	15/15	9	5	8	8	RL	RL					
77	L. E.	28	Mixed	5/15	5/15	22	24	25	25	RL	..	..	..	..	..	RL
78	R. C. E.	27	Mixed	5/15	5/15	22	23	28	30	RL						
79	T. F.	35	Mixed	0/15	15/15	50	0	54	5	R	R					
80	J. T. G.	26	Mixed	0/15	15/15	48	0	53	3	R	R					
81	W. G.	48	Mixed	10/15	10/15	9	10	21	19	RL						
82	L. V. H.	24	Mixed	5/15	15/15	14	14	15	14	RL						
83	M. G.	36	Mixed	10/15	15/15	20	1	25	1	R	R	..	..	..	..	R
84	V. G. G.	38	Mixed	0/15	1/15	32	16	41	25	RL	RL					
85	E. E. G.	29	Mixed	12/15	10/15	30	26	35	32	RL	RL	..	..	RL		
86	R. R. H.	36	Mixed	1/15	1/15	23	28	31	35	RL						

Correlation Studies—Continued

	Initials	Age	Audiographic Type	Whispered Voice		Audiographic Loss, %				Objective Findings in Drum Membrane				Past History of Otitis Media	Exposure to Severe Noise	Tinnitus
						Conversational Range		Entire Range								
				Right	Left	Right	Left	Right	Left	Lack of Luster	Retraction	Thickening	Scars			
87	E. L. H.	25	Mixed	15/15	8/15	19	24	19	28	RL	RL	..	..	..	..	RL
88	R. H. H.	36	Mixed	10/15	10/15	17	21	23	24	RL						
89	O. H.	27	Mixed	8/15	15/15	23	11	26	12	R	R	R	R	R		
90	K. W. H.	32	Mixed	15/15	13/15	1	1	2	3	RL	RL					
91	A. E. H.	27	Mixed	2/15	15/15	53	0	55	1	R						
92	E. L. J.	25	Mixed	15/15	15/15	4	7	4	9	RL						
93	R. K.	35	Mixed	0/15	0/15	39	34	41	35	RL						
94	E. A. K.	18	Mixed	13/15	15/15	6	3	6	6	RL	..	..	..	..	..	RL
95	W. R. K.	43	Mixed	15/15	2/15	4	21	15	31	RL	L	L	L	L		
96	M. L.	36	Mixed	15/15	15/15	8	12	15	19	RL						
97	J. L. L.	20	Mixed	15/15	15/15	0	17	1	24	RL	..	..	..	..	..	L
98	E. W. L.	31	Mixed	1/15	1/15	16	16	26	25	RL						
99	C. A. S.	32	Mixed	15/15	0/15	1	70	11	77	RL						
100	H. E. L.	19	Mixed	15/15	1/15	0	40	4	41	RL						
101	L. K.	25	Mixed	15/15	6/15	3	45	13	48	RL	..	..	..	..	+	
102	D. G. G.	26	Mixed	4/15	5/15	33	34	33	36	RL						
103	J. A. S.	19	Mixed	15/15	0/15	2	49	8	56	RL						
104	O. H. F.	20	Mixed	12/15	12/15	7	6	16	12	RL						
105	C. E. G.	24	Mixed	6/15	15/15	13	0	23	9	RL						
106	S. M. K.	25	Mixed	5/15	9/15	16	13	21	14	RL	..	..	..	..	..	RL
107	J. F. C.	28	Mixed	15/15	0/15	5	48	13	58	RL	RL	L	L	L		
108	V. F. R.	30	Mixed	15/15	6/15	0	39	6	40	RL	RL	..	..	RL		
109	J. D. P.	25	Mixed	1/15	15/15	34	0	40	5	RL	R	R	R	R		
110	C. J. S.	23	Mixed	15/15	15/15	0	1	1	2	RL						
111	L. L. L.	23	Mixed.	9/15	6/15	10	20	17	22	RL	..	..	..	..	..	RL
112	W. M. L.	38	Mixed.	5/15	4/15	31	39	37	43	RL						
113	J. W. G.	24	Mixed	15/15	1/15	0	25	14	35	L	L	L	..	L		
114	B. P. C.	30	Mixed	2/15	15/15	34	1	47	7	RL	R					
115	G. W. P.	26	Mixed	6/15	15/15	18	0	25	1	RL	..	..	..	..	+	
116	M. G. T.	24	Mixed	15/15	6/15	6	25	9	22	RL	L					
117	O. B. W.	34	Mixed	8/15	8/15	19	21	26	28	RL						
118	J. H. K.	26	Mixed.	15/15	4/15	0	21	1	23	RL	L	L	..	L		
119	N. J. N.	18	Mixed	15/15	2/15	0	32	4	39	RL	L	L	..	L	..	L
120	J. K.	22	Mixed	10/15	8/15	6	9	11	18	RL	..	..	..	..	+	RL
121	O. P.	29	Mixed	10/15	15/15	23	0	29	9	RL	R	R	R	R		
122	H. F. T.	35	Mixed	13/15	7/15	7	17	14	24	RL	L	L	L	L		
123	J. H. A.	26	Mixed	15/15	15/15	7	5	9	8	RL						
124	E. F. H.	28	Mixed	13/15	13/15	17	10	25	14	RL	RL	RL	RL	RL		

125	T. L. J.	18	Mixed	8/15	12/15	24	10	32	20	RL	RL						
126	N. F.	20	Mixed	15/15	14/15	4	6	6	9	RL	L	L	L	L			
127	O. B. D.	21	Mixed	15/15	15/15	2	0	14	11	RL							
128	P. M. H.	26	Mixed	5/15	12/15	42	25	42	27	RL	..	..	..	..	..		RL
129	P. G. Y.	18	Mixed	2/15	1/15	23	23	21	23	RL							
130	W. A. C.	25	Mixed	15/15	10/15	0	11	11	20	RL	L	..	..	..	..		L
131	J. J. M.	22	Mixed	10/15	15/15	46	0	43	3	RL							
132	L. M.	32	Mixed	10/15	5/15	4	9	11	8	RL	RL	R	R	R			
133	C. M.	26	Mixed	15/15	4/15	0	39	2	39	RL							
134	R. L. M.	23	Mixed	1/15	1/15	26	34	30	22	RL	RL	RL	RL	RL			
135	W. F. M.	37	Mixed	12/15	12/15	11	12	13	17	RL	RL	RL	RL	RL			
136	T. J. M.	20	Mixed	15/15	0/15	0	62	10	61	RL							
137	M. L. M.	39	Mixed	12/15	15/15	16	8	20	15	RL	RL	RL	..	RL			
138	C. G. M.	31	Mixed	1/15	8/15	50	0	41	4	RL							
139	S. R.	22	Mixed	15/15	13/15	11	16	17	18	RL	RL	RL	RL	RL			
140	R. B.	38	High	15/15	15/15	1	0	5	9	RL	..	..	..	..	+		
141	T. L. C.	26	High	15/15	15/15	0	0	5	6	RL	..	..	..	..	..		RL
142	E. E. C.	19	High	15/15	15/15	0	0	0	10	RL	..	..	..	..	+		L
143	E. E. C.	36	High	15/15	15/15	0	0	12	14	RL	..	..	..	..	+		RL
144	R. J. D.	37	High	15/15	15/15	0	12	12	22	RL	..	..	..	..	..		L
145	J. R. D.	32	High	8/15	12/15	43	16	57	24	RL							
146	M. F.	32	High	15/15	15/15	0	0	3	4	RL	..	..	..	..	+		RL
147	G. S. F.	22	High	15/15	15/15	0	0	13	17	RL	..	..	..	..	+		RL
148	C. A. G.	34	High	15/15	15/15	0	0	6	9	RL	RL	..	..	..	..		RL
149	W. G.	20	High	15/15	15/15	0	0	7	5	RL	..	..	..	..	+		RL
150	W. A. G.	25	High	15/15	15/15	0	0	9	3	RL							
151	W. E. H.	29	High	10/15	15/15	11	0	20	1	RL	R	R	..	RL			
152	C. L. H.	31	High	15/15	15/15	0	0	13	12	RL	RL	..	..	..	..		RL
153	A. L. H.	26	High	15/15	15/15	0	0	0	8	RL	..	..	..	..	+		
154	R. A. H.	22	High	15/15	15/15	0	0	8	0	RL	..	..	..	..	+		R
155	A. N.	27	High	15/15	15/15	0	0	0	11	RL	L						
156	R. A. A.	19	High	15/15	15/15	0	0	7	9	RL	..	..	..	..	+		RL
157	R. P. B.	22	High	15/15	15/15	0	0	2	2	RL	..	..	..	RL			
158	S. H. B.	19	High	15/15	15/15	0	0	1	1	RL	RL	RL	RL	RL			
159	C. W. B.	29	High	15/15	15/15	0	0	18	23	RL							
160	H. H. F.	24	High	15/15	15/15	0	0	8	7	RL	..	..	..	..	..		RL
161	J. F. K.	30	High	15/15	15/15	0	4	0	9	RL	..	..	..	..	+		L
162	J. E. K.	18	High	15/15	15/15	0	0	0	7	RL	..	..	..	..	+		RL
163	J. F. M.	32	High	15/15	13/15	0	7	2	20	RL							
164	M. O. M.	25	High	15/15	15/15	0	0	7	3	RL	..	..	..	..	+		RL
165	J. W. M.	19	High	15/15	15/15	2	0	17	19	RL	..	..	..	..	+		RL
166	M. E. O.	21	High	15/15	15/15	0	1	15	8	RL	L	..	..	L			
167	V. J. P.	22	High	15/15	15/15	0	0	8	5	RL	..	..	..	RL	..		RL
168	R. G. S.	20	High	15/15	15/15	0	0	9	10	RL	..	..	..	..	+		RL
169	J. Z.	36	High	15/15	15/15	0	0	15	16	RL	..	..	..	..	+		RL
170	D. K.	23	High	15/15	15/15	0	0	6	13								

	Initials	Age	Audiographic Type	Whispered Voice		Audiographic Loss, %				Objective Findings in Drum Membrane				Past History of Otitis Media	Exposure to Severe Noise	Tinnitus
						Conversational Range		Entire Range								
				Right	Left	Right	Left	Right	Left	Lack of Luster	Retraction	Thickening	Scars			
171	L. U. K.	34	High	15/15	15/15	0	0	16	17	RL						
172	J. F. P.	24	High	12/15	15/15	10	0	24	2	RL	..	..	..	..	+	R
173	W. L. M.	24	High	15/15	15/15	0	0	8	5	RL						
174	A. M. M.	29	High	15/15	15/15	0	0	10	10	RL	RL	RL	..	RL	+	RL
175	J. F. M.	25	High	15/15	15/15	0	0	15	12	RL	..	..	..	..	+	RL
176	J. C. M.	25	High	15/15	15/15	0	0	12	20	RL	..	..	..	..	+	RL
177	G. J. N.	21	High	15/15	15/15	0	5	9	12	RL						
178	J. N.	27	High	15/15	12/15	5	8	20	15	RL						
179	D. R. P.	27	High	15/15	15/15	6	5	18	27	RL						
180	W. D. Q.	19	High	15/15	15/15	0	2	2	9	RL	L	L	L	L		
181	C. G. R.	20	High	15/15	15/15	0	0	2	8	RL						
182	C. R. T.	39	High	15/15	15/15	0	0	5	11	RL						
183	E. N. W.	27	High	9/15	15/15	17	2	32	15	RL						
184	H. H. G.	30	High	13/15	12/15	4	10	21	18	RL	RL	..	..	RL	..	RL
185	E. W. R.	28	High	15/15	15/15	0	4	10	13	RL						
186	B. W. S.	22	High	15/15	15/15	6	2	20	19	RL	RL	RL	RL	RL	+	RL
187	L. C.	25	High	15/15	15/15	6	12	8	19							
188	D. M. F.	23	High	13/15	15/15	0	0	13	1	..	..	..	..	..	+	R
189	C. B. F.	28	High	15/15	15/15	0	0	15	16	RL	RL	..	..	..	+	RL
190	R. W. G.	23	High	15/15	15/15	0	0	21	14	..	..	..	..	..	+	RL
191	W. F. H.	18	High	15/15	15/15	0	0	14	16	L	L	L	..	L	..	L
192	A. D. H.	20	High	15/15	15/15	0	0	9	8	RL	RL	RL	RL	RL		
193	O. V. H.	22	High	15/15	15/15	0	0	2	3	RL	RL	..	..	..	+	
194	F. O. H.	28	High	15/15	8/15	0	0	3	8	RL	L	L	L	L		
195	G. L. H.	22	High	15/15	15/15	0	0	8	14							
196	R. A. J.	22	High	15/15	12/15	0	6	19	23							
197	H. O. J.	21	High	15/15	15/15	0	0	1	1	RL	RL	..	..	RL	..	RL
198	T. W. O.	30	High	15/15	15/15	0	0	12	8	RL	RL	..	..	RL	..	RL
199	L. J. S.	18	High	15/15	15/15	0	0	1	8							
200	E. E. S.	20	High	15/15	15/15	5	0	11	1	..	..	..	..	..	+	RL
201	L. M. S.	21	High	15/15	15/15	0	0	1	1	..	..	..	..	..	+	RL
202	J. D. T.	27	High	15/15	15/15	5	6	10	11	RL	RL	..	..	RL		
203	W. S. W.	36	High	15/15	15/15	0	0	19	21	..	..	..	..	..	+	
204	R. R. B.	20	High	1/15	9/15	7	19	19	27							
205	N. D. B.	27	High	15/15	15/15	0	0	14	11							
206	E. B.	26	High	15/15	15/15	0	0	1	0							
207	H. A. B.	48	High	13/15	13/15	0	0	22	18							
208	J. P. B.	39	High	15/15	15/15	1	0	13	5							
209	H. B.	17	High	10/15	9/15	3	6	7	9	RL	RL					
210	F. D. B.	20	High	5/15	1/15	11	15	15	26	RL	..	..	..	RL		

211	W. H. B.	20	High	15/15	12/15	0	4	4	15								
212	E. L. B.	20	High	15/15	15/15	0	0	2	8	..	..	..	..	..	+		RL
213	C. L. C.	25	High	15/15	15/15	0	0	14	2	..	..	..	..	..	+		R
214	M. A. C.	29	High	6/15	10/15	8	1	23	18	RL	RL	RL	RL	RL			
215	T. J. C.	27	High	15/15	15/15	0	0	4	8								
216	R. W. C.	18	High	15/15	15/15	0	0	4	1								
217	E. K.	26	High	15/15	15/15	0	0	6	2	R	R	..	..	..	..		R
218	L. B.	22	High	15/15	15/15	1	3	11	12	..	..	..	..	..	+		RL
219	E. F. S.	27	High	15/15	10/15	0	9	1	12								
220	O. O. G.	27	High	15/15	15/15	0	0	13	14	RL	RL	..	..	RL	..		RL
221	C. M. I.	22	High	15/15	15/15	2	3	12	16	..	..	..	..	..	..		RL
222	K. J. M.	25	High	15/15	15/15	0	0	0	3	L	L						
223	J. J. S.	26	High	15/15	15/15	0	0	1	2	..	..	..	..	..	+		L
224	E. C. P.	26	High	15/15	15/15	1	1	5	6	..	..	..	..	..	..		L
225	L. A. B.	33	High	15/15	15/15	0	0	13	18	..	..	..	..	..	+		
226	J. W. K.	25	High	15/15	15/15	1	2	16	5	RL	L	L	L	L			
227	R. E. C.	19	High	15/15	15/15	0	0	7	7								
228	H. R. F.	19	High	15/15	12/15	0	9	15	21	RL	RL	..	..	RL			
229	L. I. F.	36	High	15/15	15/15	0	7	2	19	..	..	..	..	..	..		L
230	E. D. G.	24	High	15/15	15/15	0	0	2	3	..	..	..	..	..	+		R
231	E. M. D.	25	High	15/15	15/15	0	3	10	9	RL	RL	RL	RL	RL	+		RL
232	T. H.	33	High	15/15	15/15	0	3	14	17								
233	O. O. E.	23	High	15/15	15/15	0	0	5	4	RL	RL	RL	RL				
234	E. E. G.	36	High	15/15	15/15	5	1	13	14	..	..	..	..	..	..		RL
235	H. W. D.	28	High	15/15	15/15	0	0	1	1								
236	E. V. G.	28	High	15/15	15/15	0	0	1	4	..	..	..	..	..	..		RL
237	J. W. G.	22	High	15/15	15/15	0	0	5	9	RL	RL						
238	C. L. G.	27	High	15/15	15/15	5	0	17	5	..	..	..	..	..	+		RL
239	J. G.	35	High	15/15	15/15	9	7	19	18	RL	L	L	L	L	..		L
240	D. J. H.	22	High	15/15	7/15	3	13	13	24								
241	H. T. H.	24	High	15/15	15/15	0	0	1	3								
242	J. S. I.	36	High	15/15	15/15	0	0	7	2	..	..	..	..	..	+		R
243	J. J. J.	21	High	15/15	15/15	0	2	0	16	..	..	..	..	..	..		L
244	R. M. L.	18	High	15/15	15/15	1	0	13	1	..	..	..	..	..	..		R
245	J. L. L.	24	High	15/15	15/15	0	0	2	1								
246	M. C. L.	26	High	15/15	13/15	3	7	5	19								
247	H. L.	24	High	15/15	15/15	0	0	9	8								
248	J. L. E.	26	High	15/15	15/15	0	2	12	12	RL	RL	RL	RL	RL	..		RL
249	P. J. C.	24	High	15/15	15/15	0	0	2	2	..	..	..	..	..	..		RL
250	O. M. S.	24	High	14/15	14/15	3	4	14	14	..	..	..	..	..	..		R
251	H. P. K.	26	High	15/15	15/15	1	1	3	4	..	..	..	..	..	+		
252	L. R. S.	25	High	15/15	15/15	3	1	10	12	..	..	..	..	..	+		
253	W. H. U.	26	High	15/15	13/15	2	8	16	18								
254	R. D. E.	21	High	15/15	15/15	0	0	6	14	..	..	..	..	..	..		RL
255	A. R. K.	20	High	15/15	15/15	1	0	13	10	..	..	..	..	..	..		RL
256	V. G. A.	19	High	14/15	14/15	0	0	17	17	..	..	..	..	..	..		RL
257	R. A. S.	25	High	15/15	15/15	0	1	2	4	RL	RL	RL	RL	RL			
258	G. W. S.	24	High	15/15	15/15	0	0	6	5	RL	RL	RL	RL	RL			
259	P. M. R.	36	High	15/15	15/15	0	0	3	10								

	Initials	Age	Audiographic Type	Whispered Voice		Audiographic Loss, %				Objective Findings in Drum Membrane				Past History of Otitis Media	Exposure to Severe Noise	Tinnitus
						Conversational Range		Entire Range								
				Right	Left	Right	Left	Right	Left	Lack of Luster	Retraction	Thickening	Scars			
260	R. L. K.	33	High	15/15	15/15	1	0	4	2	R	..	..	..	..	..	R
261	H. H.	23	High	15/15	15/15	0	0	15	15							
262	J. E. C.	19	High	15/15	15/15	0	0	15	5	RL	RL	..	..	..	+	R
263	F. W. P.	24	High	15/15	15/15	0	0	16	16	RL	RL	..	..	..	+	
264	J. C. S.	28	High	15/15	2/15	0	39	5	48							
265	R. E. F.	19	High	13/15	13/15	8	6	20	13	..	..	..	..	..	+	RL
266	R. E. T.	21	High	15/15	15/15	0	0	1	2							
267	T. R. M.	20	High	15/15	15/15	3	0	10	0	..	..	..	..	..	+	R
268	R. A. H.	26	High	8/15	13/15	17	3	25	11							
269	J. L. M.	22	High	15/15	15/15	0	0	10	7							
270	C. E. G.	21	High	15/15	15/15	0	1	0	10	RL	RL	..	..	RL	+	L
271	C. O. G.	27	High	15/15	15/15	0	2	12	17	..	..	..	..	..	..	RL
272	J. C. M.	25	High	15/15	15/15	0	0	12	9	..	..	..	..	..	+	RL
273	D. E. B.	19	High	15/15	15/15	0	0	1	2	RL	RL	..	..	RL		
274	G. C. B.	24	High	15/15	15/15	1	2	4	2							
275	J. W. G.	27	High	15/15	13/15	6	8	17	17							
276	K. D. S.	35	High	15/15	15/15	0	0	3	5							
277	E. D.	18	High	15/15	15/15	0	0	8	5	RL	RL	RL	RL	R		
278	F. V. D.	31	High	15/15	15/15	0	0	3	5	..	..	..	..	..	..	RL
279	R. P. B.	22	High	15/15	15/15	1	0	11	11	R	R	..	..	R		
280	A. K.	29	High	15/15	15/15	0	0	6	9	..	..	..	..	..	..	RL
281	C. D. S.	35	High	10/15	15/15	8	0	17	4	..	..	..	..	..	+	L
282	N. G.	27	High	15/15	15/15	0	0	5	5	RL	..	..	..	..	+	
283	E. E. C.	36	High	14/15	14/15	0	0	13	14	..	..	..	..	..	..	RL
284	J. K.	22	High	15/15	15/15	2	2	4	8	..	..	..	..	..	+	L
285	W. P. R.	21	High	15/15	15/15	0	0	0	3	L	L	L	..	L		
286	G. A. M.	37	High	1/15	1/15	20	22	24	26	RL	RL	RL	RL	RL		
287	R. D. O.	22	High	15/15	15/15	0	4	0	9	RL	RL	RL	..	RL		
288	R. B. L.	25	High	15/15	15/15	0	0	6	5	RL	RL	..	..	L		
289	V. L. S.	24	High	15/15	15/15	5	0	15	8	RL	RL	RL	RL	RL		
290	S. L. H.	26	High	15/15	15/15	0	0	9	7	RL	RL	RL	RL	RL		
291	E. G. H.	30	High	6/15	15/15	22	0	33	7	RL	..	..	..	..	+	
292	F. H. S.	25	High	15/15	15/15	1	2	7	9	RL	..	..	..	RL		
293	V. F. D.	31	High	15/15	15/15	0	0	4	1	RL	RL	RL	R	RL		
294	W. A. C.	24	High	15/15	15/15	0	0	5	2	RL	RL	..	..	L		
295	E. H. H.	20	High	0/15	15/15	40	0	65	2	RL	RL	RL	R	RL		
296	D. D. V.	21	High	15/15	15/15	0	0	3	8	RL	RL	..	..	..	+	RL
297	L. B.	23	High	0/15	15/15	43	0	38	0	R	R	R	R	R		
298	G. W. A.	22	High	13/15	15/15	6	1	9	1	RL	RL	RL				
299	E. W. H.	27	High	15/15	15/15	2	1	16	20	RL	RL	R	R	R		
300	D. O. C.	24	High	15/15	13/15	0	13	4	17	RL	L	L	..	RL		

In studying the table it is noticed that in only 2 of 300 cases of defective hearing was the impairment of the true low tone variety. This substantiates the view that pure low tone hearing defects rarely occur. Of the 300 unselected cases represented, 54 per cent are of the high tone type. This fact alone assumes practical importance when it is noticed that in 53 per cent of the high tone cases, the whispered voice test and the audiographic percentage loss in the conversational range revealed no loss of hearing. However, an audiographic analysis of the entire perceptional range in these cases revealed the presence of numerous defects which were not detected by the whispered voice test. Coates [3] has strongly emphasized that the detection of incipient losses of hearing is of utmost importance if restoration to normal is to be obtained or if progression to an incapacitating degree of deafness is to be avoided.

The lack of correlation between the results of the whispered voice test and audiographic analysis is apparent. The practical implication is obvious since this series of cases indicates that in over one half of the 300 unselected cases the hearing would be adjudged normal. Experience shows that persons who have this undetected type of hearing loss do not do well in a noisy environment. In many of them noise will cause a progression of the high tone defect, so that an encroachment on the conversational range will eventually occur. In these persons noise often initiates intractable tinnitus and causes distortion of normal reception of sounds and deep aural pain. The table shows the incidence of tinnitus to be very high in persons with high tone deficiency and greater in these than in persons with any other type of hearing disturbance. Of those with high tone deficiency whose whispered voice tests showed normal hearing and who had normal hearing in the audiographic conversational range, 52 per cent complained of tinnitus.

From the military as well as from the industrial point of view, diminished audition increases the hazard to the patient and to his co-workers and decreases the patient's efficiency. With diminished audition there is an inhibition of those body reactions to environment which depend on acoustics and occurrence of sounds that quicken the attention and stimulate action. When the perception of sound is depreciated or distorted, there will be misinterpretation of communicative ideas, misunderstanding of orders, apparent stupidity, passiveness to danger and often outright embarrassment and confusion.[4] The discrimination between the person with normal hearing and the person with normal hearing but with a potentially unstable and susceptible acoustic mechanism should be made in order to prevent subsequent

3. Coates, G. M.: The Prevention of Deafness, Ann. Otol., Rhin. & Laryng. **40**:651-660 (Sept.) 1931.

4. McBride, E. D.: Disability Evaluation, ed. 3, Philadelphia, J. B. Lippincott Company, 1942, pp. 597-598.

adversities. The value of audiometry is evident in making this discrimination. It has been pointed out previously that methods other than electroaudiography are unreliable and fail to reveal early defects of the hearing mechanism.[5] The detection of acoustic deficiencies should occur long before serviceable hearing is impaired. From this standpoint alone, electroaudiography is an indispensable part of any method used in the evaluation of hearing efficiency. No other method can detect and measure these early and significant changes. In correlating the loss of acuity shown in the whispered voice test with conversational percentage loss calculated from audiographic findings, it must be kept in mind that correlating perception of articulated sounds with perception of discrete pure tones is basically unsound. Since the correlation frequently is made inadvertently, the results of tests of perception of articulated sounds must be compared discretely with the results of tests of perception of pure tones expressed in the form of a percentage loss of speech.

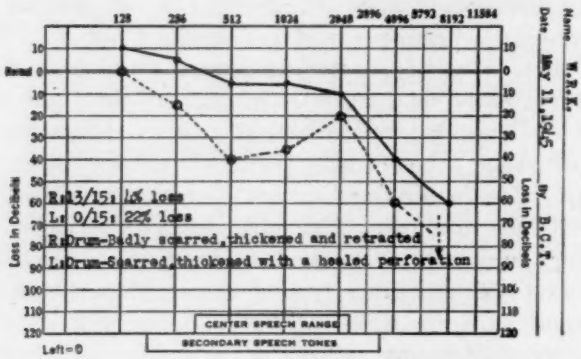

Chart 2.—Correlation of objective findings and hearing loss in a given case.

In general, the tendency to correlate objective findings with the efficiency of hearing is clinically reasonable. Unfortunately, the appearance of the tympanic membrane in no way permits a definite conclusion to be made regarding the status of hearing. It is noticed in the table that the objective findings in persons with low tone and mixed type audiographic deficiencies bear little relation to either the whispered voice loss or the audiographic loss. Abnormal findings are as frequently associated with normal hearing as with defective hearing. These observations are particularly impressive in view of the fact that frequently similar binaural distortions are found with definitely disproportionate losses of hearing acuity in the two ears. The audiogram in chart 2 illustrates a case in which similar binaural distortions were accompanied by a wide variation in the hearing acuity of the two ears.

5. Trowbridge, B. C.: Electroaudiography: Analysis and Interpretation of the Audiogram, Arch. Otolaryng. **35**:899-914 (June) 1942.

The tuning fork tests were performed in many of the cases. The selection of subjects was limited to the more alert and cooperative patients. Under the best of conditions the subjects often gave confusing and contradictory results. A frequent observation was the presence of abnormal fork findings in a case in which the result of the whispered voice test was normal. The Weber test was of special aid in such cases, in which bilateral hearing was normal by the whispered voice test. It served as a rapid means of detecting those persons with hearing defects which were not demonstrable by the voice test. The principle of unequal lateralization as an indication of hearing deficiency proved to be an efficient and practical method of sorting out these persons, who were in the previously tested normal group. Owing to the complex nature of most of the hearing deficiencies, the fork results as a whole were inconsistent, and precise conclusions could not be made from them alone. In general the correlation between audiographic findings and fork test results was not consistently demonstrable. The lack of correlation between the tests is due not only to the complication of hearing defects but also to incorrect interpretation of the results of the tuning fork tests. Results of experiments made by Perlman [6] and of correlation studies in precision testing with the audiometer show that the interpretation of the fork tests, in relation to high and low tone loss, has not been altogether correct.

The audiograms shown in chart 3 illustrate cases of uncomplicated conduction defects. Each one represents a case in which the defect involved only one part of the conduction system. A defect of the external auditory canal, the middle ear or the eustachian tube will upset the conduction mechanism and produce the audiographic and fork results which are illustrated in these audiograms.

The first audiogram in chart 3 illustrates the case of a patient who stated that she suddenly became deaf in the right ear on the previous day after a bath. There was no past history of ear trouble. Following this sudden deafness, the patient noticed that she could not hear her watch tick in the right ear. Otoscopic examination of the right ear showed the external auditory canal completely closed with impacted cerumen. Examination of the left ear revealed no abnormalities either in the external canal or in the ear drum. The impacted cerumen was removed by irrigation. Further examination of the right ear showed no pathologic changes in the right ear drum. The nose and the throat were normal. Auto-inflation of the eustachian tubes was accomplished without difficulty.

The second audiogram in chart 3 represents the case of a pilot whose left ear suddenly became plugged on the previous day during descent. He complained that he could not hear out of his left ear. Examination of the left ear revealed an injected tympanic membrane, which was markedly retracted. All the landmarks were accentuated. A clear fluid with bubbles could be observed in the tympanum through the drum membrane. The right tympanic membrane was

6. Perlman, H. B.: Lesions of the Conduction Apparatus, Arch. Otolaryng. **37**:680-690 (May) 1943.

normal. There was no previous history of ear trouble. Both external auditory canals were normal. The examination of the nose and the throat revealed no abnormality. Autoinflation of the eustachian tubes was satisfactorily accomplished.

The right ear of the patient concerned in the third audiogram in chart 3 became plugged on the previous day. Sneezing and a postnasal mucoid discharge accom-

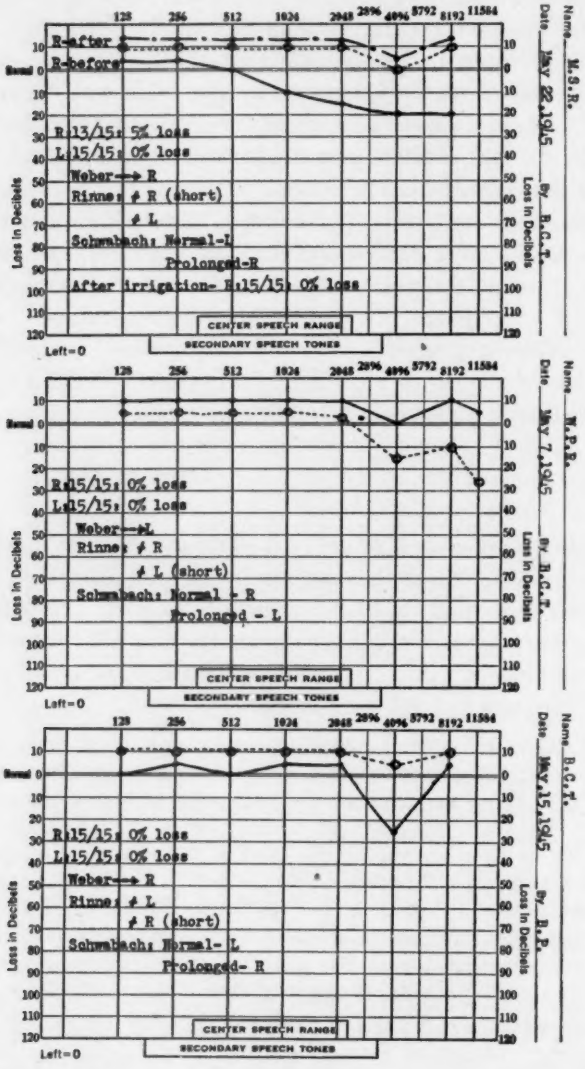

Chart 3.—First audiogram: Defect of the external auditory canal (impacted cerumen) with correlation of audiographic and fork findings.

Second audiogram: Defect of the middle ear (aero-otitis) with correlation of audiographic and fork findings.

Third audiogram: Defect of the eustachian tube (allergic salpingitis) with correlation of audiographic and fork findings.

panied the disturbance of the ear. The patient complained that the sounds of his voice seemed to resound in the right ear loudly. He also stated that sounds from the outside were distorted when he was listening with the right ear. Examination of the nose revealed a pale and edematous mucous membrane which was typically allergic in appearance. The throat was normal. There was no past history of ear trouble. Both external auditory canals and tympanic membranes were normal. Autoinflation of the left eustachian tube was satisfactorily accomplished. The right tube could not be self inflated.

In studying the three audiograms it is noticed that a high tone loss results from these uncomplicated conduction defects, that the Weber test lateralizes to the side with the high tone loss arising from the conduction defect and that the Schwabach test remains prolonged on the side with these high tone deficiencies. Not infrequently it was noticed that the Rinne test became negative several days after the onset of aerootitis whereas it had been positive soon after the inception of the aerootitis. This switch from a positive Rinne to a negative Rinne test was not always accompanied in the audiographic pattern by a corresponding change of high tone loss to low tone loss. The high tone loss usually persisted in the presence of a negative Rinne test. It was also noticed that the subjective complaint of the hearing loss was all out of proportion to the loss shown by the whispered voice test or to the conversational percentage loss. This is epsecially true in cases in which defective hearing is associated with nasal allergy. Kuhn [7] has previously pointed out that lowered hearing is present with nasal allergy. This has been observed frequently. Pending the time when these findings will be generally accepted by otologists, any effort to correlate tuning fork tests with audiographic analysis and whispered voice tests in view of the old explanations would be fruitless. Many questions concerning the physiology of hearing will be answered when the physiology of the eustachian tube in its relation to hearing is clarified.

SUMMARY AND CONCLUSIONS

Comparative studies of the commonly used hearing tests and the correlations of their results indicate that one is not justified in drawing precise conclusions as to hearing efficiency from these methods as they are now employed. The good hearing required in modern warfare and modern industry is submerged in an environment of noise and vibration. Normal hearing acuity alone is not sufficient in the evaluation of hearing function. The acceptable applicant, military or industrial, should be able to interpret signals, communicative ideas and orders correctly and to distinguish every change of pitch and of character of sound in an environment of noise and vibration.

7. Kuhn, H. A.: Allergy in Hearing Defects, J. Indiana M. A. **36**:143-147 (March) 1943.

The hearing tests as commonly used do not detect the unstable and susceptible hearing mechanism. It is commonly known, although frequently disregarded in the interpretation of test results, that normal hearing acuity does not necessarily indicate a normal and stable hearing mechanism. It is therefore of profound importance to test the hearing function as to the rate of fatigue, the effect of fatigue on hearing acuity, the threshold of the excitation of tinnitus and the presence of discrete high tone defects.

The whispered voice test as a regulation test for the hearing of those entering military service should be supplemented by pure tone audiometry. Pure tone audiometry should be a requisite in the selection of all applicants, military or industrial, who will be exposed to a background of noise. The testing of hearing acuity by controlled articulation (speech) tests received against a background of measured noise would seem to give an additional practical evaluation of hearing acuity and efficiency.

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LEARNING THE LEMPERT FENESTRATION OPERATION

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LEARNING the technic of the Lempert fenestration operation is difficult because of at least two factors inherent in the procedure itself. In the first place, almost every move in this new and complex operation is different from any previous otologic technic. In the second place, each step in this operation requires the most minute exactitude to avoid disaster. In no other operation are slight errors in technic apt to be as costly as those in the fenestration operation.

The difficulties in learning this technic are increased, first, because of the lack of sufficient and close observation of fenestration operations perfectly performed on the living and, second, because of insufficient practice on the cadaver. Each maneuver, each surgical detail of the operation, is specific in its meaning and its execution. These technics must be observed time and time again to understand their significance. The difficulties must be overcome and a perfect technic achieved to insure to the patient his best chance for permanent restoration of hearing. The surgeon who performs this operation with faultless skill will be able to attain two to four times the number of desired results achieved by one whose skill is mediocre. The purpose of this paper is to give some specific clues which may help surgeons to train themselves to a maximum degree of technical efficiency.

Many outstanding and experienced otologists tend at first to see similarities to their old familiar technics in some parts of the fenestration operation. Only as the doctor progresses in experience can he observe the differences. Dropping out the old habitual motions and replacing them by new and different ones is not easy. So often, even though one means not to repeat the old technical habits and is fully aware of the need to use the new maneuvers, one yet repeats the old motions reflexly. A good deal of practice is needed to change these old, well established habits.

Most of the instruments used in the fenestration operation are altogether new, and new maneuvers must be learned with them. While the curets are similar to those used in the past, for the fenestration they are constructed longer and weighted differently, and they must be held and manipulated in new ways. New adjustments must also be made while working with the magnifying loop. There may be consider-

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able awkwardness in the use of these instruments at first, which is disturbing but which obviously should be the normal expectancy. The engine-driven bone-cutting drill is a tool which most otologists have never used. The choice of the proper burr and the knowing when, where and under what conditions it may be used with safety, and with how much pressure, require a good deal of trial and error practice. Since all the maneuvers are more or less unique and unfamiliar, they must be repeated very often before one gets the "feel" of them.

In learning to perform the fenestration operation the second great difficulty is the absolute necessity of achieving accuracy in all manipulations. In the most crucial parts of the operation, if one does just not enough or one does just too much, the purpose of the operation may be defeated and the hearing completely destroyed. This applies particularly to the creation of the new fenestra. Extreme care must also be taken in the making and the maintenance of an intact plastic flap of the skin and the drum and in the removal of small bone fragments adherent to the flap close to the drum. Rigorous and precise performance is required.

The student must watch closely the expert technic demonstrated in the operating room and strive to imitate this technic on the cadaver. It is apparent that many details will be missed even with close observation. For this reason one cannot watch too many fenestration operations. Fortunately, most of the steps of the fenestration operation can be performed remarkably well on the cadaver. Watching and doing go hand in hand, each one making the other more meaningful. This means going back again, and again, and again to observe in the operating room and then imitating on the cadaver again, and again, and again.

How many operations has one to watch, how many cadavers to do? The answer is—as many of both until one can perform the entire operation faultlessly many, many times on the cadaver. Until that feeling of ease is achieved, one cannot feel confident or even prepared to operate on a patient. Cadaver work, moreover, should not be limited to practice on the right side alone, even though that is the more comfortable one to operate on. The patient's left ear must sometimes be operated on, when it is the deafer of the two. If I had to state what number of fenestration operations a surgeon should observe and how many cadaver operations he should perform before actually operating on a patient, I would say that he must have gone through each process at least one hundred times over a period of a year or more. Whenever possible, watching and doing should alternate. Perhaps the doctor may prefer to operate on several cadavers and then go again to observe, or vice versa. This may seem a very heavy task imposed to achieve the goal of learning the fenestration operation, but one needs to repeat over and over again this complicated technic on all sorts of variable anatomic

specimens, so that the final performance may become as highly skilful and fluent as that of a distinguished violinist playing a long-rehearsed concerto.

This number of operations observed and of cadaver repetitions done is essential. Even after expert technic has been achieved there is still great tension present during every successful performance. Excessive tension, anxiety or fear at the operating table will tend to increase technical errors. Even if in a given case the surgeon is able to avoid committing errors, the accompanying excessive tension and anxiety are certainly not conducive to his own best health. But why should excessive tension occur at all? The patient who seeks the fenestration surgeon is often somewhat maladjusted because of his deafness. The intensity with which such a patient wishes for good hearing is matched by the intensity with which the surgeon wishes for a good result. By the same token, the patient's intense longing for good hearing is equaled by his dread of the failure of the operation. The operation being an elective one, the surgeon somehow assumes the burden of the hopes and fears of the patient. If the surgeon can be confident that he can perform a perfect technical operation, then he has made his greatest possible contribution to the patient and any excessive tension at the operating table will be eliminated.

This factor of excessive tension has emphasized clearly the importance of constant and critical observation and of repetitive cadaver practice. One of the ablest fenestration surgeons of today had observed more than forty fenestration operations and operated on over forty cadavers when he first put this technic into practice several years ago. After a few operations on the living he was convinced that he had not yet had sufficient cadaver experience to proceed with easy confidence and equanimity. He returned to practice on the cadaver and multiplied his operating room observations. He then was able to resume his operating room practice with great success. It is obvious that the next fenestration operation is not the same as the last fenestration operation if you have behind you the experience of having performed ninety-nine (on the patient or the cadaver).

Another reason for persisting in sustained cadaver work is that it is thus that one learns to control technical errors. We achieve this control by commiting on the cadaver the very errors which make the operation dangerous. When we learn how the dangers occur, we learn then what "not to do." If the surgeon learning fenestration technic has not erred repeatedly on the cadaver, he will tend to be too tense in the operating room, because he is anticipating those dangers which he has learned to fear and dread but which he has not been able to "get out of his system" by constant and familiar practice. Cadaver practice should supplement early operational experience until a good backlog of successful performances has been achieved.

The fenestration technic is an exciting and beautiful one. It constitutes a new and great contribution to otology. There are many patients seeking surgical relief, and a good number of results are extremely gratifying. One can look for even better results when further improvements in technic are made. To become expertly trained in this procedure will lead to confident and enjoyable practice of surgery, which certainly seems well worth the effort.

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SCULPTURED SYNTHETIC PROSTHESES AS IMPLANTS IN PLASTIC SURGERY

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THE APPEARANCE of new literature to describe artificial substances and the technic of building these materials as substitutes for missing parts of the body indicates the limitations of materials that plastic surgeons have had to work with. Problems of the shape of the cartilage and the bone of the donor, of the absorption of the transplanted living material and of hand molding of cancellous bone have limited the sculptural effects otherwise possible in plastic surgery.

But quite clever implantation technics were devised by imaginative surgeons. The diced cartilage technic for the filling of defects under the skin is one of these. Yet there is a need for further versatility in the adoption of useful implantation materials.

Prosthetic implants of ivory, celluloid, steel and tantalum are a partial fulfilment of the need for such materials. The newer synthetic resins, those which can be polymerized to a state of biologic inertness, promise immense advantages in this field. Thus, as described by Brown,[1] prostheses should be looked on as of two types:

1. The type indicated when surgical intervention is contraindicated. Here are included cases in which coexisting disease or other disability makes surgical treatment inadvisable and cases in which surgical manipulation of the tissue would end with esthetically undesirable results.

2. The second type of prostheses (which Esser has called the "bloody" type) are those which necessitate surgical incisions for their establishment. Sculpturally molded synthetic implants come under this heading. What is the difference between the synthetic material now to be described and the previously used ivory, celluloid and cartilage? This material is molded from sculptured models; it will not slip out of place, since it fits only one area; it will not curl and will not shrink, nor has it been found to be a source of irritation of tissue because of its composition.

In the planning of a technic of restoration to meet postwar demands, certain desirable features must be set down, which must be satisfied

• From the Eye and Ear Infirmary, University of Illinois.

1. Brown, A. M.: Sculpturally Molded Synthetic Implants in Plastic Surgery, Arch. Otolaryng. **39**:179 (Feb.) 1944.

The technic should yield ideal implants possessing the properties of stability, adaptability and lightness. A technic should be devised whereby the operator is presented with a medium—unlimited in shape and previous configuration—which can be easily molded to follow the sculptured planes desired. The method should yield a final product well tolerated by the tissues and not subject to dimensional changes or distortion. As far as satisfying quantitative demands, one should expect an inexpensive and not too involved procedure applicable to a majority of cases.

To date many approaches to the problem of implantation—making use of different implant materials—have been tried in plastic surgery.

Paraffin implantation, a relatively simple and inexpensive procedure, consisted of injecting paraffin in a low melting state underneath the skin and then shaping it before solidification took place. While this method almost satisfies one's standards as far as esthetics and simplicity are concerned, there is a great drawback when one considers the degree to which the tissues of the host tolerate the final hardened paraffin implant. In most cases the tissues about the implant respond by the formation of a chronic granuloma, which tends to become carcinomatous. Many operators, probably fascinated by the directness of the approach and the ease of operation, have even attempted by this method to correct the saddle noses of syphilitic patients.

The opposite problem arises when one attempts to make use of technics involving ivory, celluloid, synthetic substances and animal material. While here the inertness of the materials seems to make them easily tolerated by the tissues of the host, the ease with which the implants can be worked and molded to the proper esthetic form is lost. In this case the surgeon deals with a rigid substance which must be carved and does not permit freedom of manipulation.

When one considers a material less inert in character, more closely resembling the structural makeup of tissue, another problem is encountered. The more inert a material is, the less the living tissues about it are subject to unfavorable reactions. Therefore, when fascia and fat implants, bone and autogenous and homogeneous cartilage implants are used one can expect reaction to occur in the surrounding tissues. When the implants are live animal material, autogenous in origin, they tend to be absorbed by the host tissue. Absorption or extrusion is also the probable fate of implants of live material homogeneous in nature. With use of foreign inert materials the problem of absorption is not met. Not only are implants of live animal material prone to absorption, but the operator is not afforded a plastic workable medium in which to attain the pleasing contours and delicate facial adjustments so necessary for accurate results. The factor of time is also important.

Why should it be necessary for an entire group of operative assistants to stand about while the surgeon attempts to sculpture secondary curves, such as the graceful curves of the glabella of the nose, by the slow process of carving under sterile conditions? And what degree of freedom of manipulation can be expected when, for example, an operator attempts delicate creations in a substance such as cartilage or bone that have a definite grain structure and a previous configuration; and if after tedious efforts, working under pressure all the way, a good restoration in say bone has been attained, how can he be sure that this form will be kept when the bone is grafted? For it is usually conceded (Naffziger,[2] Kilodney[3]) that eventually the graft is absorbed so that only a thick fibrous portion of it remains. How much simpler it would be if one could make use of a medium permitting unlimited freedom of delicate expression, which could be molded and shaped at leisure away from the operating room, and then accurately duplicated in every detail in a material that comes closest to fulfilling all the specified requirements!

THE MAKING OF THE IMPLANT

For convenience, the technic can be divided into stages.

Stage 1.—In the first stage the operator takes a negative impression of the deformity and of the area about it, which may influence its esthetic anatomy. Using petrolatum jelly as a separating medium, he coats the skin of the face lightly with it, applying a thicker coat on the eyebrows so that the hair will not become too strongly encased in plaster. Then, after coating the inside of the unplugged nostrils, he mixes up a batch of no. 1 molding plaster and spreads it over the face, remembering to let some flow into the nostrils. After a moment, the patient is instructed to open up the nasal airways and preserve the outline of the external and vestibular aspects of the nose by exhaling sharply through the nose.

Stage 2.—The second stage consists in making a positive cast of the face. This is done by pouring alpha gypsum into the negative plaster impression of the face after the impression has been further coated with petrolatum and plugged at the nostrils to prevent adhesion and loss of gypsum.

Stage 3.—This is the restoration stage. A temporary substance is placed on the defective feature seen on the positive cast and worked to yield the desired restoration. Any material that can be washed out cleanly so that its impression is left as a space between an opposed die and a counter die can be used. Because it can be molded to give the desired planes, primary flexures and secondary curves, I use sculptor's clay. Dental wax or Plasticine can also be used, but they do not permit the same freedom of manipulation. A profile photograph of the patient's face can well serve as a useful guide in determining the angulation and

2. Naffziger, H. C., in discussion on Grant, F. C., and Norcross, N. C.: Repair of Cranial Defects by Cranioplasty, Ann. Surg. **110**:511, 1939; The Restoration of Defects of the Skull, ibid. **104**:321, 1936.

3. Kilodney, A.: Osteoplastic Repair of Cranial Defects, Am. J. Surg. **46**: 365, 1939

the size of the nose to be restored. A line is drawn on this profile photograph through the anterior edge of the forehead and the chin. It is of practical significance to note that an angle of approximately 30 degrees with the first line is formed by another line drawn from the glabella to the tip of the nose. While this angulation applies to normal people, it must be understood that people undergoing plastic surgery are not normal as far as facial appearances and anatomic facial angulations and relations are concerned, and may not be too rigidly held to the strict normal rules. One must also understand the psychology of a patient who seeks facial restoration. How he may be prone to exaggerate his admiration of the opposite extreme. For example, a person seeking correction of a long nose may want his nose shortened far beyond the point to which the plastic surgeon believes it should be shortened. The plastic surgeon must realize that the patient has had his sense of esthetics distorted and is in no position to make a dependable choice.

Stage 4.—This is the die and counter die stage. When the restoration in clay is finished, key holes are dug here and there in the unsculptured portion of the positive cast. Now the cast is coated with petrolatum and another batch of alpha gypsum paste poured over this ensemble to form the second half of the mold. After the newly poured portion sets, the two portions are separated and the clay washed out. This leaves a die and a counter die which when placed in opposition engulf in a medium of plaster a spatial impression of the clay nose.

Stage 5.—This is the stage of processing. In this stage the space between the die and the counter die is filled with an acrylic resin of putty-like consistency, which by means of heat and pressure can be made to undergo polymerization and emerge as a material meeting almost every requirement for a good implant. The first step in processing is to remove the petrolatum by running both halves of the mold through hot water. After the plaster dries, both inner surfaces are covered with lead foil, cellophane or a commercial acrylic separating fluid.[4]

Next the plastic putty-like mass is packed into the space between the opposing molds. This plastic mass consists of a powdered polymeric methyl methacrylate partially dissolved in a liquid monomeric methyl methacrylate. In the course of curing the monomer probably undergoes polymerization and links the partially dissolved particles together into a homogeneous state.

Usually the resins are prepared in two ways: (1) in a form already plasticized by the manufacturer by the addition of the correct amounts of monomer and polymer, and (2) in the separate liquid monomer and powdered polymer states, designed to be mixed at the time of use. If the latter resin preparation is obtained, the powder is placed in a medicine glass and liquid added to give the proper putty-like consistency. This mixture is allowed to stand for five to ten minutes.

Now one is ready for the trial packing, which consists of packing the plasticized acrylic mass into the proper recess of the mold and covering with wet cellophane. The two halves of the mold are pressed together tightly and then separated so that the position and the amount of acrylic resin can be observed. If there is an excess of acrylic resin flowing out of the recess and spreading in all directions, it should be removed now, for later, after it has hardened, it is harder to trim. Also, if one notes that not all portions of the recess are sufficiently filled with acrylic resin, now is the time to add to the deficient amounts at the proper places.

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4. This is marketed under the name Film-Ac by Justi and Son, Inc., Philadelphia.

Again one closes the mold, presses the dies tightly, and places them under pressure by means of a vulcanizing press. The press and flasks are immersed in water which is slowly brought to a boil. Immersing immediately in boiling water will cause evaporation of parts of the liquid monomer before it has had time to

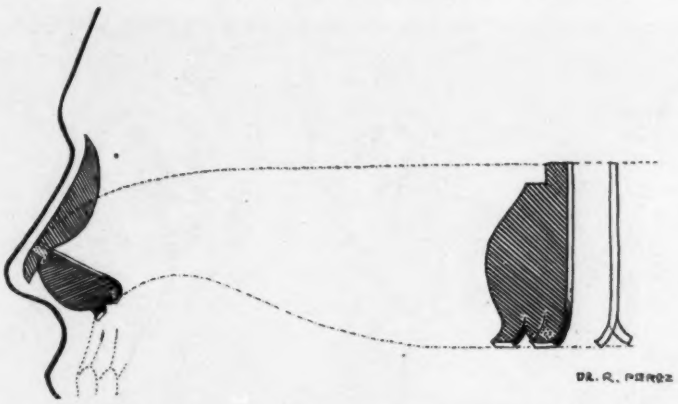

Fig. 1.—Schematic illustration of a sculpturally molded methyl methacrylate implant used to raise the ridge of the nose. The implant is fitted with a sheet Lucite strut. The strut hinges into the dorsal piece, and its posterior end is forked, as illustrated, for stability.

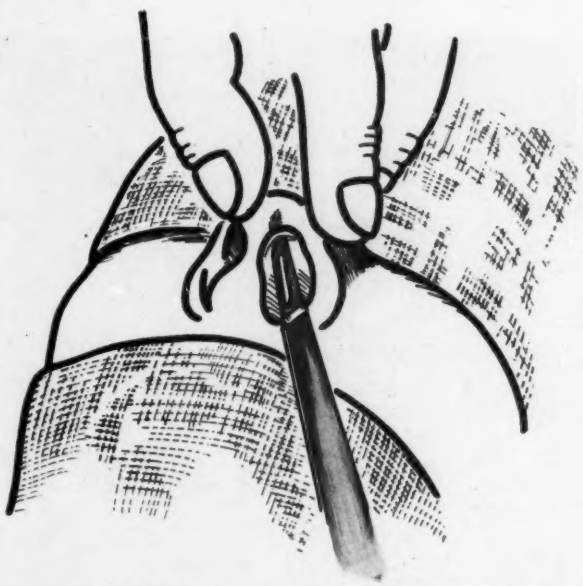

Fig. 2.—A simple invisible incision for the insertion of the implant.

polymerize. Sometimes, one purposely permits the boiling water to seep into the ensemble of die, counter die and resin. This causes porosity, which is sometimes desirable in prosthetic aids which are to be placed under the skin; connective tissue grows into the crevices and helps to make the prosthesis more stable as

to position. After approximately thirty minutes of heat treatment, the implant is removed and trimmed with an acrylic file or on a carborundum wheel. Holes about 1/16 inch (1.5 mm.) in diameter are drilled here and there through the sculptured piece, and then it is polished.

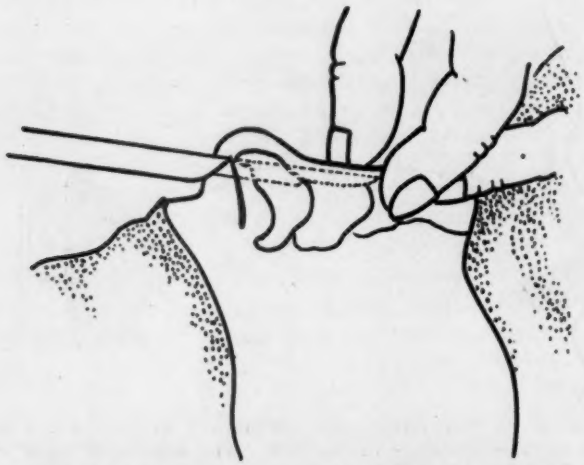

Fig. 3.—The incised pocket may be freely widened; there is practically no danger that the implant will slip out of position, since it is molded to fit its bed.

Fig. 4.—*A*, complete loss of septum after infection. Note upward retraction of nasal tip. *B*, contour restored with an implant as illustrated in figure 1.

In polishing to a fine finish, one can use tripoli, pumice and, finally, diamond or whiting—applied to a rag wheel revolving at slow speed.

THE IMPLANTATION

The surgical procedure is similar to the usual procedure of implantation. One may have to use a slightly larger incision, owing to the

Fig. 5.—*A*, loss of nasal bridge after trauma.. *B*, contour restored with a one piece sculptured implant.

Fig. 6.—*A*, congenital loss of bridge with wide profile angle. *B*, contour corrected with a one piece molded synthetic implant. Note the change in the profile, particularly the reduction of the nasal angle and the increase of height from the eye to the root of the nose.

presence of curves and planes unattainable in other substances. For an internal nasal prosthesis, an incision made inside the vestibule of the nose is probably best. Since the acrylic implant fits better than crude carvings, the surgeon need not be so concerned with a minimum

Fig. 7.—*A*, congenital receding chin. *B*, contour improved with a sculpturally molded synthetic resin implant.

Fig. 8.—*A*, complete absence of nasal bones after old trauma and infection. *B*, contour restored with a sculpturally molded implant. The reconstruction was performed as shown in figure 1.

undercutting of skin. The hand-carved internal prostheses (e. g., those of ivory and cartilage) have a tendency to slip and change position if given the slightest space in which to do so. With this method, however, the operator may take care that the pocket surgically provided

is liberally sufficient in dimensions to allow the skin to relax over the implant.

As in any other operation for placing an implant, hematoma is guarded against. Once the prosthetic implant is in position, a few cubic centimeters of thrombin, topical, N. N. R.,[5] is instilled into the wound, just enough to moisten the entire depth of the incision. This serves a double function. It effects prompt hemostasis, and when the thrombin combines with the plasma of the wound, the precipitated fibrin fills holes, crevices and pores of the implant, helping to anchor it more firmly in place.

The technic described holds many points in its favor. The final acrylic implant meets every one of the requirements that were listed as being essential for a good implant material. Not only do acrylic restorations enjoy stability, tolerability and adaptability; they do not show any dimensional changes or undergo warpage. The simplicity and inexpensiveness of the technic and the fact that it calls for an intermediate medium of clay, unlimited in donor size, shape or previous configuration, make it a good postwar possibility.

For the future, one of the most important points in favor of this type of synthetic prosthesis hinges on the fact that the final restoration material need not be fixed in its physical and chemical nature. Synthetic materials can be compounded to meet almost any set of properties desired. It shows many future possibilities of chemical variation to meet special cases. One must also remember that when one incorporates synthetic resins into any technic one immediately places oneself in a position to profit by the vast research done all over the world in the growing field of chemical plastics. One literally obtains the aid of thousands of chemists, for every gain in the field of synthetic plastics is a possible gain in a field of plastic surgery based on a technic incorporating plastics as restoration materials.

NOTE.—Methyl methacrylate implants are transparent to roentgen rays and sensitive to alcohols and ketones. Probably because of the increase of ketone bodies, acrylic implants are contraindicated in diabetes.

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5. This is marketed under the name Thrombin (Bovine) Topical by Parke, Davis and Company, Detroit.

Case Reports

OSTEOMYELITIS OF THE SPHENOID BONE

Report of a Case with Complete Recovery

COLONEL KENNETH M. KAHN
Medical Corps, Army of the United States

CAREFUL perusal of the literature substantiates the statement made by Wilensky that the diagnosis of osteomyelitis of the sphenoid bone is rarely made except at the postmortem table. In 1929 Kramer reported 9 cases which had come under his observation. He stated that up to that time only 100 cases had been recorded in the literature.

Few additional cases were reported during the period in which the sulfonamide compounds were the only antibiotic agents. The end results, however, remained 100 per cent fatal. I am not aware of any case in which penicillin therapy has been employed alone or in conjunction with adequate surgical intervention, regardless of the final result.

The case to be reported was diagnosed clinically, and the diagnosis was supported by roentgenologic examination and confirmed by microscopic section. The clinical diagnosis was based on long-standing severe hemicrania on the right side which was not controlled by the administration of adequate doses of hypnotics or analgesics and on the presence of a fetid purulent postnasal discharge and recurrent massive nasopharyngeal hemorrhages.

REPORT OF CASE

A soldier sustained multiple penetrating wounds of the face from Japanese mortar shell fire on April 8, 1945. There was immediate and complete loss of vision. He was evacuated to the Zone of Interior, arriving at Valley Forge General Hospital on June 7. Throughout the journey he complained of severe hemicrania on the right side. He had three separate postnasal hemorrhages, which subsided spontaneously.

At Valley Forge General Hospital his blood pressure was 145 systolic and 90 diastolic. The red cell count was 2,800,000 and the white cell count 10,000. After a transfusion these counts increased to 3,390,000 and 12,800, respectively. The hemoglobin was 9.5 Gm. (Fisher). The general condition of the patient improved until June 26, when he suddenly lost 1,500 cc. of blood from the nasopharynx. There was no apparent reason for this severe hemorrhage. It was controlled by postnasal packing. Reexamination of the roentgen plates, which at first failed to reveal damage of the sphenoid bone, showed almost complete destruction of the anterior surface and roof of the sphenoid sinus. There was marked disease in the right frontal and ethmoid sinuses.

Hemorrhage recurred on July 6 and 9, 500 cc. being lost each time. A postnasal pack controlled the bleeding on each occasion. Consultation of the surgeons of that hospital resulted in the opinion that the hemorrhage was from one of the large intracranial vessels and would have to be controlled by ligation of the carotid artery. In view of the fact that there was damage of the sphenoid bone with the

possibility of hemorrhage starting from the portion of the internal carotid artery contained within the cavernous sinus or from some point in the circle of Willis, so that a transcranial approach to the bleeding vessel might become necessary, the patient was transferred to Halloran General Hospital, a neurosurgical center, arriving July 11.

Stereoscopic roentgenologic examination was done by Lieut. Col. A. B. Soule Jr. He agreed that there was advanced disease of the frontal and ethmoid sinuses and that there was probably osteomyelitis of the body of the sphenoid bone.

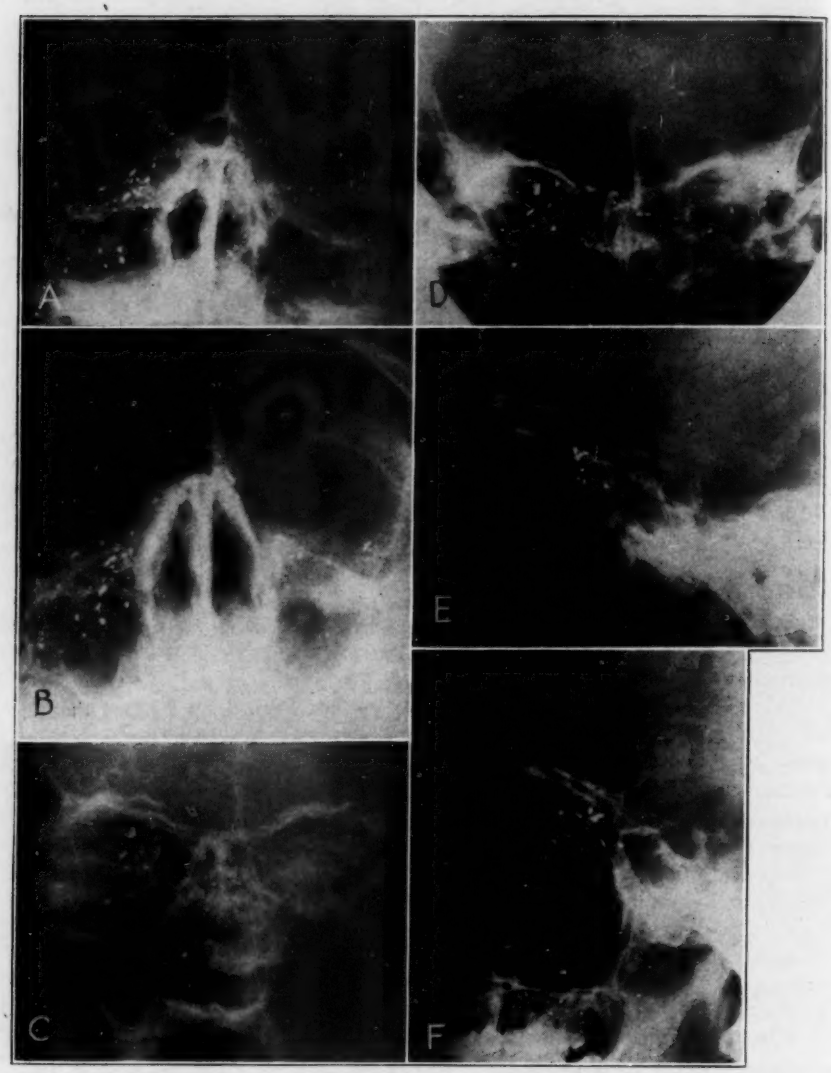
The patient had been receiving 20,000 units of penicillin every six hours for nine days prior to July 10. This dose was immediately increased to 50,000 units, given intramuscularly every three hours. Radical external frontoethmoidectomy was performed on July 12. The frontal sinus was completely filled with pus and polypoid tissue. Culture of the pus revealed penicillin-sensitive hemolytic staphylococci and anaerobic nonhemolytic streptococci. Part of the anterior and all of the posterior laminas of the frontal bone were necrotic. The diseased bone was removed, exposing the entire under surface of the right frontal lobe of the brain. When the anterior surface of the sphenoid bone was reached, through the natural ostium an old blood clot was seen to be contained within the sinus. The face and the superior aspect of the floor of the sphenoid sinus were necrotic. The necrotic bone was carefully removed by forceps and curets. The opening into the sphenoid sinus was just large enough to admit the index finger of the operator in case of hemorrhage should the blood clot be disturbed. The clot was removed by suction. Massive hemorrhage of more than 500 cc. immediately followed. It was controlled by introducing the left index finger into the hole in the face of the sphenoid sinus. Two large pieces of Oxycel gauze [1] were packed into the sphenoid sinus through the external part of the nose. The external wound was packed tightly and left open for drainage and future dressings. The patient received 2,000 cc. of whole blood during the operation.

The arterial color of the blood and the rapidity of flow established that the hemorrhage was of other than purely cavernous sinus origin. It was believed to be coming from the portion of the internal carotid artery contained within the sinus.

Microscopic examination (Major Helmuth Sprinz) was reported as follows: "The section shows cancellous bone covered by respiratory epithelium such as is present in the paranasal sinus area. The bony trabeculae are delicate and viable. The marrow spaces are filled with fibrous connective tissue and show cellular reaction, predominantly of leukocytes. This reaction is consistent with the diagnosis of chronic osteomyelitis. The mucous membrane lining the bony tissue shows a moderately intense chronic inflammatory reaction of leukocytes, plasma cells and eosinophils. These findings are consistent with the diagnosis of chronic sinusitis."

The postoperative history was uneventful until July 21, at which time there was a sudden massive hemorrhage of more than 2,000 cc. With the patient under general anesthesia, the packing was removed and replaced. A transfusion of 2,000 cc. of whole blood was given. The common carotid artery was ligated at this time by Lieut. Col. R. N. Schullinger, chief of the surgical service. There was no further bleeding until July 27, when about 250 cc. was lost. The external packing was changed. The packing was greenish and foul smelling. Culture later revealed the presence of Bacillus pyocyaneus. Local instillation of streptomycin, 10,000 units per cubic centimeter, was instituted. The dressing was replaced

1. Oxycel gauze is an absorbable oxidized cellulose (polyanhydroglucuronic acid) in sterile gauzelike form, used as a hemostatic agent.



A, advanced disease of the right frontal and ethmoid sinuses, with marked destruction of the frontal ridge and of the ethmoid bone.

B, postoperative appearance of the frontoethmoid area.

C, posterior view of the ethmoid and sphenoid areas. Note the break in continuity in area of the roof of the sphenoid sinus.

D, postoperative frontoethmoid area. The Granger line is not distinct on the right side.

E, appearance before operation. Note the marked absorption in the region of the dorsum sellae turcicae.

F, appearance six months after operation. Note the regeneration of bone in the inferior dorsum sellae region.

on July 29. There was no discharge or bleeding at this time. The wound was redressed every four or five days, with the patient in the sitting position, without hemorrhage until August 23. In this hemorrhage between 500 and 750 cc. of blood was lost.

A consultation was had with Lieutenant Colonel Schullinger and Major Whitcomb of the neurosurgical section. It was decided that ligation of the right internal carotid artery could now be accomplished without the usual fear of hemiplegia on the left side. During the ligation an effort was made to introduce fibrin foam into the internal carotid artery, but this could not be done because of the strong reflux from the right external carotid artery. Recovery was uneventful after this procedure.

The following progress note was written October 15: "The patient's wound has been redressed every third or fourth day with light intranasal and external packing. There has been no bleeding since the ligation of the internal carotid artery. Packing was discontinued on October 1. The patient continued to receive 50,000 units of penicillin every three hours until the packing of the wound was discontinued. It is apparent from visualization of the sphenoid cavity that normal mucous membrane is contained therein. There is little secretion within the sphenoid sinus. It is mucoid in character and there is absolutely no evidence of bleeding seven weeks after ligation of the internal carotid artery. There are no cerebral manifestations of ligation of the carotid artery."

A roentgen examination of the sphenoid sinus made on October 10 was reported as follows: "There is now evidence of definite improvement in the appearance of the sphenoid sinuses, which contain air and show only slight thickening of the lining mucous membrane. The body of the sphenoid bone is denser, probably from new bone formation in the area of former osteomyelitis."

The patient was last seen on March 1, 1946. There had been no recurrence of hemorrhage, and he was undergoing rehabilitation for the blind at Valley Forge General Hospital.

A case of chronic suppurative frontoethmoiditis with chronic osteomyelitis of the frontal and sphenoid bones secondary to multiple shell fragment wounds resulting in bleeding from the portion of the internal carotid artery contained within the cavernous sinus has been presented. The diagnosis was made clinically and roentgenologically and was substantiated by microscopic observations. Adequate surgical intervention and massive penicillin therapy were instituted early. Ligation of the internal carotid artery was finally required to control hemorrhage. There are no manifestations of cerebral atrophy following the ligation of the artery. Thirty-four million units of penicillin was given to prevent intracranial disease. There has been no evidence of penicillin toxicity during or following this massive administration. The patient is well, with roentgenologic evidence of bone repair in an area known to be osteomyelitic.

Cognizant of the results published by other authors in similar cases, I feel justified in believing that the unusual end result obtained in this case is not due to surgical intervention alone but must be due in greater measure to the specific bacteriostatic effect of penicillin.

15 Beach Street, Staten Island, N. Y.

FOREIGN BODY INVOLVING THE ETHMOID SINUS

CLARENCE W. ENGLER, M.D. and JOSEPH H. MELANT, M.D., CLEVELAND

BEFORE WORLD WAR II foreign bodies involving the paranasal sinuses were so rare that the subject was seldom indexed in the standard texts. Jackson and Jackson [1] treated the topic for the first time, though briefly. Reports of a few scattered cases can be found in periodical literature, the majority dealing with a tooth in the maxillary sinus. Richardson [2] recently reported the successful extirpation of a pin which had been present in the maxillary antrum for fifty-nine years. Golden [3] called attention to a patient with an air rifle buck shot in the posterior ethmoid sinus and cited similar cases—all the foreign bodies were removed intranasally.

However, since the termination of hostilities more reports of sinuses containing foreign bodies, primarily shell fragments, are being brought forth. Here again the maxillary sinuses are seen to be particularly vulnerable because of their size and location.

It cannot be stressed too strongly that any foreign body lodged in a paranasal sinus should be removed early in order to prevent osteomyelitis, meningitis or brain abscess. Sinusitis is inevitable.

The paucity of literature on the topic prompts us to report this interesting case:

A. J., a 34 year old Negro, presented himself to the ear, nose and throat clinic of the outpatient department of the Cleveland City Hospital, May 31, 1946, complaining of severe frontal headaches "due to a knife blade in my head." Four years previously his wife had stabbed him in the region of the glabella. Two months later he was inducted into the Armed Forces. During his entrance physical examination, roentgenograms of the skull revealed the metallic foreign body. He was accepted for service, but no surgical removal was attempted because of some difficulty of localization. Because of the severe persistent headaches, the patient on one occasion attempted suicide. He was finally discharged from the Army because of symptoms related to his foreign body.

The roentgen report at the Cleveland City Hospital was: "Metallic foreign body in the right anterior cells of the ethmoid sinus."

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1. Jackson, C., and Jackson, C. L.: Diseases of the Nose, Throat and Ear, Philadelphia, W. B. Saunders Company, 1945.

2. Richardson, G. A.: Foreign Body Involving the Maxillary Antrum, Arch. Otolaryng. **43**:508-510 (May) 1946.

3. Golden, M. G.: Air Rifle Buck Shot in Left Posterior Ethmoids, Ann. Otol., Rhin. & Laryng. **49**:1032-1035 (Dec.) 1940.

On July 11, external frontoethmoidotomy was done, with the patient under anesthesia produced by intravenously injected pentothal sodium. A Lynch incision was made, and the periosteum, lacrimal sac and pulley of the superior oblique muscle were freed. The ethmoid vessels were ligated and severed. The ethmoid sinus was opened with a rasp, and free pus exuded. Staphylococcus albus and hemolytic streptococci grew from the culture. The rusty, corroded knife blade was found lying in the sinus, parallel to the nasofrontal duct. The duct was widened and the floor of the frontal sinus removed because of the purulent material and the polypoid mucosa found in it.

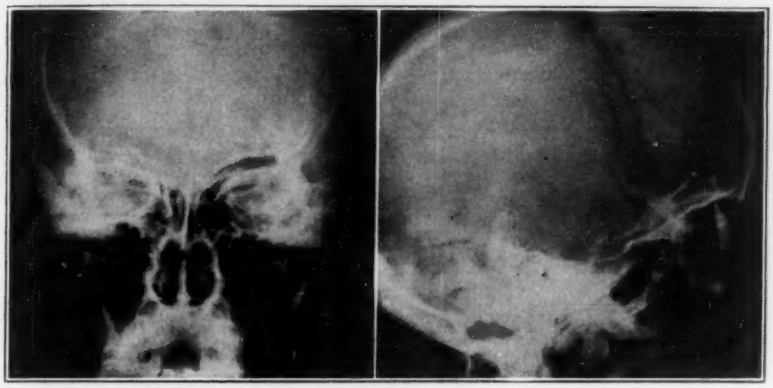

Fig. 1.—Posterior-anterior and lateral views showing the blade.

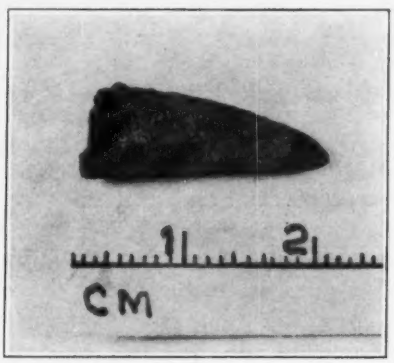

Fig. 2.—Knife blade removed in its entirety. Postoperative roentgenograms revealed no foreign body.

The right frontal and ethmoid sinuses were cleaned out. Iodoform gauze and a rubber tube drain were placed in the frontal sinus and brought out through the right nostril.

On the sixth postoperative day, after removal of the packing and the tube, the patient was discharged. For two weeks he complained of diplopia of the right eye, apparently due to the freeing of the pulley. However, since that time he has had no complaints. The incision is hardly noticeable, and the widened nasofrontal duct has remained open.

SUMMARY

A case is reported in which the blade of a penknife lodged in the right ethmoid sinus was removed by the external approach, with very satisfactory results.

Because of unavoidable trauma to the pulley of the superior oblique muscle, the patient complained of diplopia for two weeks.

Foreign bodies in the paranasal sinuses invariably cause sinusitis.

A survey of the literature shows an increase of sinal foreign bodies, many incurred during the war. In the "Medical Cumulative Index" we can find no report listed of a foreign body being removed from the ethmoid sinus by the external approach.

GLOSSODYNIA AND EXFOLIATION OF PAPILLAE FILAMENTS AFTER ORAL ADMINISTRATION OF PENICILLIN

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MEDICAL CORPS, ARMY OF THE UNITED STATES

THE CASE of this report is unusual in its manifestations and, so far as I was able to determine, is the initial case of such complication reported. The reaction, which consisted in glossodynia, exfoliation of the filaments of the filiform papillae and edema of the tongue, occurred after oral administration of penicillin and recurred on two subsequent attempts to use this mode of penicillin therapy.

REPORT OF A CASE

In a 36 year old white man there developed an undetermined type of streptococcic sore throat with typical clinical symptoms and physical findings. There had developed on two previous occasions headache, vertigo, nausea and mild vomiting and malaise when sulfathiazole and sulfadiazine were administered orally. In order to avoid further acute reactions to sulfonamide compounds, it was decided to give penicillin. The oral route was selected because the patient refused hospitalization and circumstances prevented giving injections of penicillin every four hours. The patient received the penicillin with instructions for self administration.

On the fourth day the patient complained of a "sore tongue, which had peeled off." On inspection the tongue was smooth, red, swollen and mildy tender. There was no abnormal fissuring, and the filaments of the filiform papillae were lacking. The pharyngitis had subsided.

Because of the unusual sequelae reported in this instance of oral application of penicillin, the patient's cooperation in returning two times subsequently with sore throat was elicited. The results in the two instances were fundamentally comparable and are here presented as a single report.

Application.—Penicillin, coup sur coup, 20,000 oxford units per vial, diluted with distilled water or isotonic solution of sodium chloride to a concentration of 10,000 units per cubic centimeter, was used the second time, and lozenges for oral use were given the third time. The method of treatment was hourly applications during waking hours by local swabbing and gargling, with a volitional attempt at temporary retention of the diluted penicillin in the area of infection. The residual penicillin resulting from this method of local application was for the most part swallowed. The total daily units thus used approximated 12,000; the amount actually entering the blood stream was probably small.

Results.—On the second and third day the papillae filaments of the tongue became stained yellowish brown and felt lifeless subjectively and objectively. The tongue became painful to light pressure and had a constant burning sensation. The edema was evident in the increased thickness, the deep fissure down the center of the papillated surface and the conspicious pressure marks of the mandibular teeth on the margins of the tongue. On the third to fourth day, the burning

sensation and mild redness extended beyond the tongue into the pharynx, and all the filaments of the filiform papillae could be and were dramatically rubbed off the tongue with light pressure. The edematous, denuded tongue, with the deep central fissure, was hyperemic and tender. The tongue became normal in appearance after three to four days with gargles of hot isotonic solution of sodium chloride. Normal regrowth of the filaments of the filiform papillae occurred in each instance in two to three weeks.

SUMMARY

Penicillin administered orally by local application during treatments of three separate episodes of pharyngitis in a patient produced discoloration and hardening of the filaments of the filiform papillae of the tongue, also glossodynia and edema of the tongue and a burning sensation of the tongue and pharynx. After three to four days a denudation of all the filaments of the filiform papillae occurred, leaving a smooth, edematous, hyperemic, tender tongue, with pressure markings consisting in a deep central fissure and impressions of the mandibular teeth on the margin. The tongue appeared normal, except for its denudation, on the third and fourth days. The filaments of the filiform papillae had regenerated to normal contour and texture in two to three weeks.

FOREIGN BODIES RETAINED IN INFANTS

HERBERT S. FRIEDMAN, M.D., NEW YORK

TWO BIZARRE cases in which infants were treated in the department of otolaryngology of the Columbia-Presbyterian Medical Center, New York, recently serve to illustrate some of the more common causes of delay of endoscopic diagnosis. In a 5 week old infant an open safety pin, and in a 14 month old child a large plastic button, were retained in the hypopharynx for over seven weeks, with no harmful sequelae resulting in either patient.

REPORT OF CASES

CASE 1.—R. H., a 12 week old infant, was admitted to Babies Hospital, Dec. 11, 1945, with a seven week history of hoarseness and a draining cervical fistula. At the onset of the illness, when the child was 5 weeks old, her cry became weak and muffled. Three days later a swelling appeared just below and lateral to the hyoid bone on the left side. This gradually became fluctuant, necessitating external incision and drainage on the twelfth day. Her temperature fell to normal and remained normal during the subsequent course, but drainage of the sinus tract persisted. On the forty-fifth day the sharp end of a pin could be seen protruding through the cervical wound. Efforts to remove the pin externally were unsuccessful. Feedings continued normally, and the child did not appear acutely ill. Roentgenograms were taken for the first time.

An examination made at the hospital on admission, at the end of the seventh week of illness, revealed a fairly well developed and nourished infant of 12 weeks with a hoarse cry and a fungating mass of granulation tissue on the left upper lateral aspect of the neck. Through the sinus tract in the mass just lateral to the hyoid bone the sharp point of a pin could be seen protruding for a distance of 1 cm. during exertion. Roentgenograms revealed a large safety pin, open at right angles, with the keeper well down in the esophagus and the sharp point extending laterally from the hypopharynx through the entire thickness of the tissues of the left side of the neck.

Laryngoscopy disclosed in the left piriform sinus a mass of granulation tissue arising from the lateral wall. This was uncapped, exposing the spring of a safety pin. The pin was removed by displacing it to the right side of the pharynx and then slowly extracting it through the mouth. The mass of granulation tissue absorbed rapidly, and the child left the hospital on the seventh postoperative day.

CASE 2.—R. T., a 14 month old Negro child, was admitted to Babies Hospital with an eight week history of vomiting and respiratory distress. Two months before admission the child was believed to have swallowed a plastic button about the size of a 25 cent piece. Castor oil was given that day, but the child continued to vomit all solid foods eaten. Roentgen and fluoroscopic examinations were

From the Department of Otolaryngology, Columbia-Presbyterian Medical Center; John D. Kernan, director.

Fig. 1 (case 1).—R. H., aged 12 weeks, with the sharp end of a safety pin protruding through a mass of granulation tissue on the external surface of the neck during exertion.

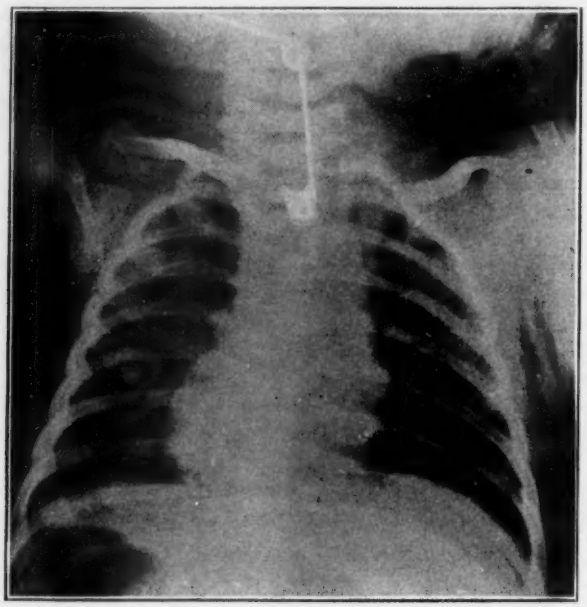


Fig. 2 (case 1).—Anteroposterior roentgenogram of the neck revealing an open safety pin lodged in the hypopharynx.

said to have shown no abnormality. Two weeks later the mother noted that the child had "crowing respiration" at night, particularly aggravated by "sleeping on her back." The child was examined roentgenologically on several occasions, with negative results. As respiration and deglutition became more embarrassed, the child was brought to the Columbia-Presbyterian Medical Center.

Examination on admission revealed a well developed and nourished child with "crowing respiration," orthopnea and respiratory thoracic retraction of a moderate degree. Her temperature was 101.5 F. (by rectum), and coarse rhonchi were heard over the entire chest. Roentgen examination revealed no abnormalities

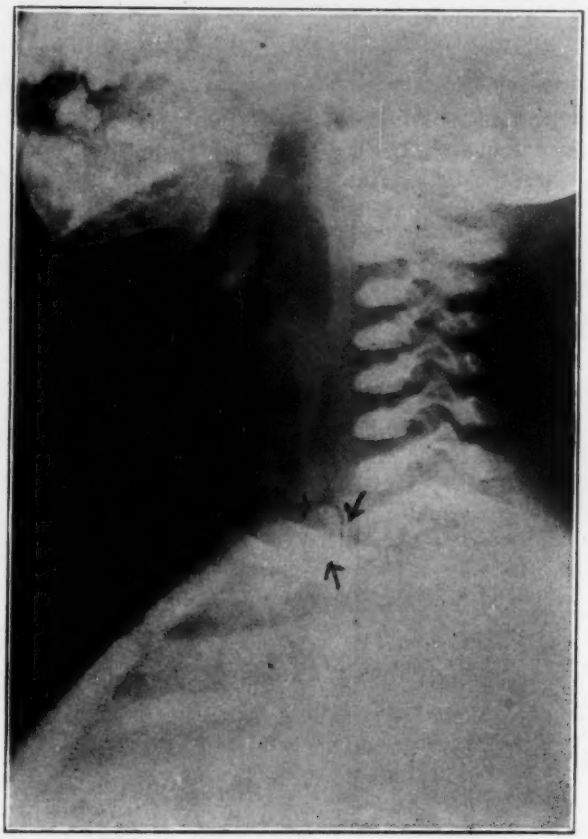


Fig. 3 (case 2).—Lateral roentgenogram of the neck (retouched) revealing the upper segment of a plastic button in the esophagus at the level of the cricopharyngeal muscle. Anteroposterior roentgenograms revealed no abnormality.

in the anteroposterior view. However, in the lateral projection of the neck, just above the thoracic inlet there was a curved shadow in the partially gas-filled esophagus that suggested a nonmetallic foreign body.

Laryngoscopy was performed immediately, without anesthesia. Protruding through the cricopharyngeal constrictor muscle was the upper tip of a plastic button, 2.5 cm. in diameter. This was removed.

The child was observed for one week, at the end of which time she was taking a full diet without difficulty.

SUMMARY

The case histories of 2 infants with large retained foreign body of the hypopharynx are presented. The first patient, a 12 week old white girl, had swallowed an open safety pin seven weeks before admission. The pin lodged in the hypopharynx, and its presence was not suspected until the sharp point of the open pin was seen protruding through the soft tissues of the neck. The second patient, a 14 month old Negro girl, had a large plastic button wedged in the region of the cricopharyngeal muscle for over eight weeks; the fluoroscope and routine anteroposterior roentgenograms showed no abnormality. Severe respiratory embarrassment finally led to hospitalization and diagnosis. Both patients made uneventful recoveries after endoscopic treatment.

These cases demonstrate the fact that even infants as young as 5 weeks of age can swallow or aspirate foreign bodies. They stress the need for careful history taking and roentgen examination, including lateral views and, when necessary, barium studies, of all patients suspected of retaining foreign bodies.

Clinical Notes; New Instruments and Technics

NEW RONGEUR FOR REMOVING A NASAL HUMP

V. H. KAZANJIAN, M.D.
AND
E. M. HOLMES, M.D.
Boston

THERE ARE several ways in which the bone and cartilage may be removed in the course of a plastic operation for an oversized nose. The accepted methods have utilized a saw, a rasp, a chisel or a combination of any two of these. It occurred to one of us (Dr. Kazanjian) that the employment of a rongeur would be efficacious. Not only would a rongeur create a clean straight cut, but it could remove the bone and cartilage through and through with one motion.

With this in mind, we advised a pair of straight-cutting bone rongeurs.* One rongeur has the blade on its lower surface; the other has the blade offset upward. The former (fig. 1) was designed so that it would cut straight through the bone without changing its path or injuring the tissues below the cut.

In most cases the skin is sufficiently movable to permit the utilization of this rongeur. Occasionally a nose is encountered in which it is nearly impossible to elevate the vestibule sufficiently high to permit the use of the rongeur at the desired level. All that is needed is about a quarter of an inch offset upward. To meet this requirement a ronguer was designed with its cutting blade offset in this manner (fig. 2). It has a drawback, however, in that the sides which carry the blades must each have a shoulder for strength, and these shoulders, though rarely, may hit some of the underlying bone before the jaws have closed, thus pushing the blades upward. When this occurs, the resulting irregularity may be smoothed off with a rasp or trimmed with the rongeur.

USE OF RONGEURS

The skeleton of the dorsum of the nose is exposed by any acceptable procedure. Then instead of a saw, a chisel or a rasp, the rongeur is inserted through one vestibular incision. By palpation, the blades are placed at a chosen level and in a plane which should be in the direction of the final cut (fig. 3). By applying a slight pressure through the skin over the rongeur, the blades will not slip and by a steady gentle pressure on the handles, the blades can be felt to cut into the cartilage and bone. If the tip of the rongeur is placed so that it will cut through the nasal bones at the point near the glabella, the entire hump will come away. Occasionally, in cases in which there have been old fractures the cut is not as smooth as is desired, or further lowering of the nasal bones may be necessary; then each bone and cartilage may be trimmed separately under direct vision. Before this is done,

From the Plastic Clinic of the Massachusetts Eye and Ear Infirmary.

* The rongeurs are manufactured by T. J. Noonan Co. Agents, 911 Boylston St., Boston.

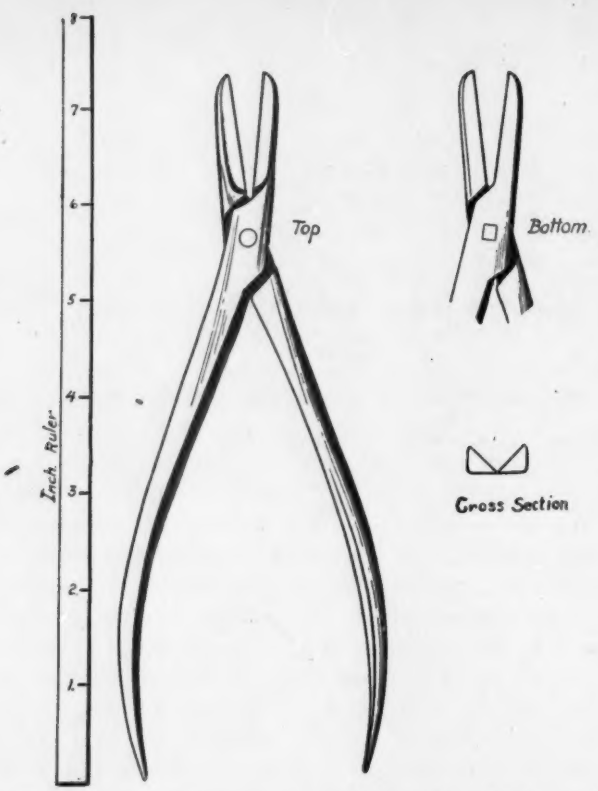


Fig. 1.—The rongeur is shown as seen partly opened and lying on a table. The cross section is made to show the position of the cutting edges. It can be noted that they meet in a plane and on the under surface of the instrument. The angle coming down to this plane prevents the instrument from slipping upward once the instrument starts to bite. This is the instrument that can be used in most cases. The instrument may be compared with the scale for size.

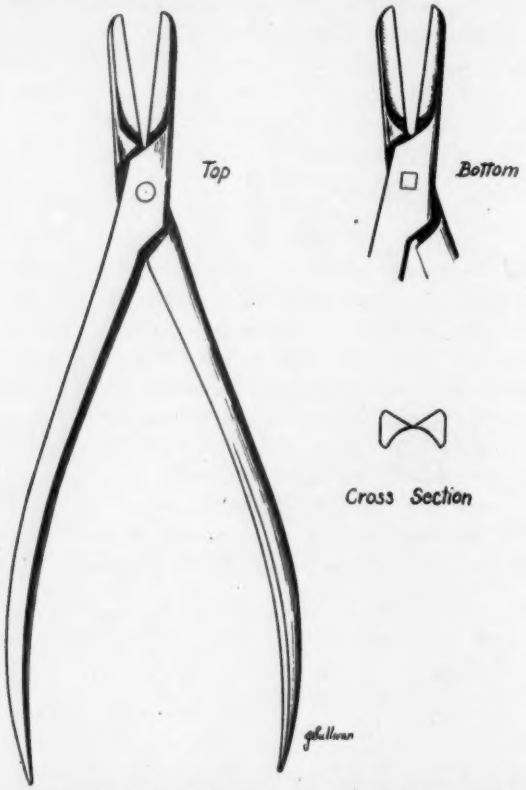


Fig. 2.—This rongeur is employed to remove a hump on a nose whose vestibule is small or cannot be elevated sufficiently. It will be observed that the cutting edges of this instrument are halfway toward the upper surface, so that nearly a quarter of an inch of room is gained.

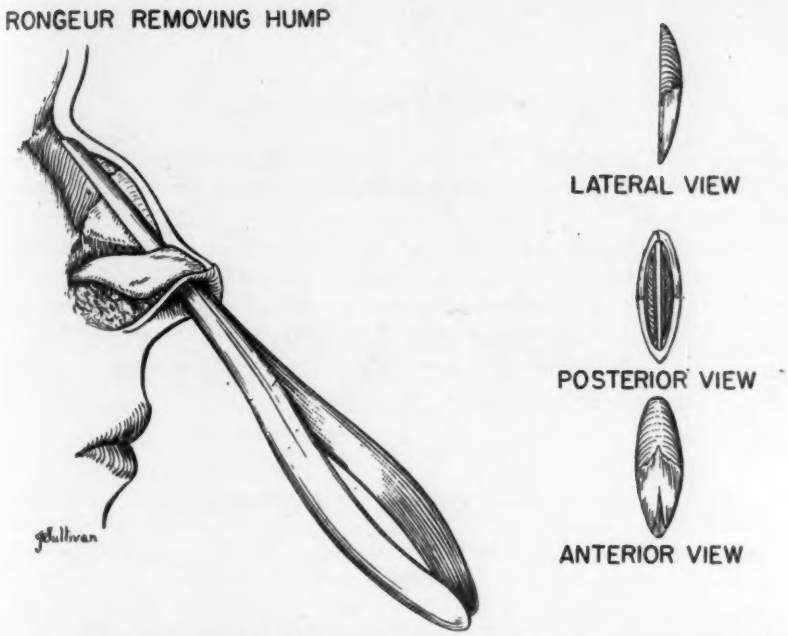


Fig. 3.—This diagrammatic picture illustrates the method of employment of the rongeurs. Observe that the tip of the rongeur is at the dorsum near the glabella and that the level of the cutting edges is in the plane of the desired dorsum. At the right are the views of the removed hump. The posterior view shows the lining mucous membrane of the nose.

Fig. 4.—The rongeur here can be seen entering one vestibular incision and ready to be closed, thus cutting off the hump.

it is advisable to extend the cut made between the septum and the lateral wall of the nose along the dorsum to the tip so that the lateral cartilages are separated from the septum.

With this exposure, the septum and either lateral wall may be trimmed under direct vision. Not only are the bone and cartilage removed in a straight line, but with them the lining membrane of the nose as well. The only place where a rasp is occasionally needed is in the vicinity of the solid bone at the glabella.

The rest of the rhinoplasty is then conducted by procedures of one's own choice.

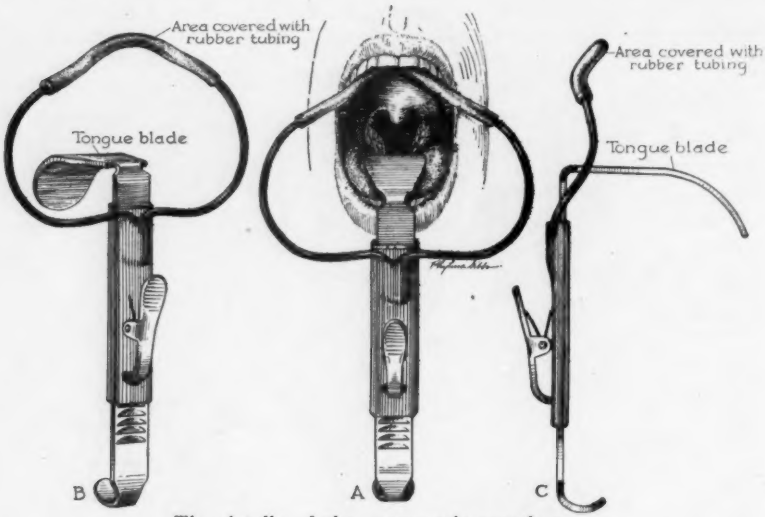
475 Commonwealth Avenue (Dr. Kazanjian).

A NEW ATRAUMATIC MOUTH GAG

ROBERT J. McIVOR, M.D.
Oakland, Calif.

THE VARIETY of mouth gags to be found in the average operating room would seem to be mute evidence that none of these gags is entirely satisfactory.

The frequency with which teeth are dislodged during the course of tonsillectomy has been, next to bleeding, one of the most frequent hazards encountered in this operation. In children the baby teeth are on the point of falling out about the time



The details of the atraumatic mouth gag.

that tonsillectomy is usually performed. In older children the adult incisors are not yet well rooted and so are not always equal to the strain thrown on them. In adults the presence of capped or pivot teeth creates a similar problem.

All of the mouth gags in use at the present time depend for their upper point of contact on the incisor teeth. Some even contact the two front incisors. The Davis gag, which seems to be most popular, may in some cases contact the canine teeth, but too often the curve of the teeth does not approximate the curve of the gag and, as a consequence, contact may come entirely on one tooth. The Whitehead and

Jennings gags are much safer than any of the others, but these gags lack a satisfactory tongue depressor and so lose a good deal of their usefulness.

The ideal mouth gag to be used in tonsillectomy should have the following qualifications:

1. It should not traumatize the teeth.
2. It should provide good exposure.
3. It should fit any mouth from that of the smallest child to that of the adult.
4. It should fit the edentulous patient.
5. It should be easily adjustable, so that the tongue blade can be moved from side to side to give exposure.
6. It should be of simple construction.

With these qualifications in mind I have endeavored to develop a mouth gag to meet these requirements. This new gag has the orthodox ratchet base which is common to most of the gags in use at the present time. To this base there is attached an elliptic-shaped ring. This ring is molded as shown in the accompanying illustration. That portion of the ring which comes into contact with the upper teeth fits behind the canine teeth, which are well rooted and equal to the strain imposed on them. The wire which is used to form the ring is a no. 12 steel wire which is first tempered soft for molding and then retempered hard to stand the strain and keep its shape. The contact portion is covered with a small piece of rubber tube, which is an added protection but not entirely necessary.

The contact with the upper teeth is the most important and the only original feature of this gag. This contact is placed behind the canine teeth, where there is no danger of trauma. No contact whatever is made with the incisors. The type of wire used for the arch is of small enough caliber so that there is little obstruction to vision, the wire fitting well into the notch behind the canine teeth. The curve of the contact area is such that rotation of the gag to move the tongue blade for exposure of the tonsil assures a two point contact with the upper teeth at all times. In the edentulous patient the upper bar fits under the upper alveolar ridge and gives satisfactory leverage. In the case of the average mouth gag the thrust on the upper teeth is upward and outward, which has a tendency to dislodge the teeth in the forward direction, owing to this outward thrust. This feature has been corrected in the gag which I describe, by bringing the upper arch out of line with the long axis of the gag so that the thrust is perpendicular to the upper jaw.

SUMMARY

A mouth gag is described which would seem to incorporate all of the requirements of a more satisfactory gag for tonsillectomy.

119 One Hundred and Thirteenth Street.

Abstracts from Current Literature

Ear

PSYCHOGENIC DEAFNESS. NORVIL A. MARTIN, Ann. Otol., Rhin. & Laryng. **55**:81 (March) 1946.

This study was done in the Hearing Center at Hoff General Hospital, Santa Barbara, Calif., and indicated that psychogenic deafness is not rare. Evaluation is greatly facilitated by pentothal sodium narcosis. Twelve per cent of the patients studied in this manner were found to have psychogenic deafness. Of the patients with blast injury admitted to the hospital, 38 per cent were found to have pure psychogenic deafness or organic deafness with a large functional factor. An outline of the method of selection of patients is given, but further study is necessary in the development of criteria for the selection of patients to be treated by this method. The treatment given is outlined and a number of illustrative audiograms presented.

M. V. MILLER, Philadelphia.

PENICILLIN THERAPY IN EXTERNAL OTITIS. BEN H. SENTURIA, Ann. Otol., Rhin. & Laryng. **55**:90 (March) 1946.

The author reports a study of penicillin solutions and penicillin-sulfonamide mixtures, the first used in strength of 500 to 2,000 units to the cubic centimeter and the latter 500 units to the gram; 32 ears were studied in all. Penicillin solution applied topically produced unsatisfactory results in 10 out of 11 cases in which diagnoses of acute diffuse, chronic eczematoid or chronic desquamative otitis were made. Rapid subsidence of pain and cellulitis and formation of well localized abscesses occurred within twenty-four to forty-eight hours in 6 cases of circumscribed external otitis with intramuscular injections. Equivocal results were obtained in 7 patients treated with the penicillin-sulfonamide powder.

If smear and culture indicate that penicillin organisms predominate in the external canal, good therapeutic results may be anticipated from the use of intramuscular injections of penicillin and possibly from topical application, but it was found that if the predominating organism found was a gram-negative bacillus the use of this antibiotic would not be effective.

M. V. MILLER, Philadelphia.

THE USE OF RESIDUAL HEARING. A. C. FURSTENBERG, J. A. M. A. **132**:138 (Sept. 21) 1946.

This illustrious otolaryngologist brings out many truths in his informative paper. He advocates a program of measures preventive of deafness, but reemphasizes what is often forgotten or neglected after preventive measures have been formulated, namely, the management of the deaf patient. It is so true that in many cases deafness cannot be prevented—for example, in those of certain of the exanthemas. Such cases should be watched for and dealt with as thoroughly as possible.

He discusses the scientific contributions of Crowe and Guild with reference to using radiant energy in the destruction of lymphoid tissue responsible for occlusion of the eustachian tubes, the surgical methods used in the treatment of clinical otosclerosis by Passov, Bárány, Holmgren and Sourdille, culminating with the one stage operation of Lempert, and the humanitarian contributions that have been made by the rehabilitation centers of the Army and Navy in strategically located parts of the United States.

Though clinical the incidence of otosclerosis has been estimated at from 5 to 30 per cent; in the author's clinic it was found to be about 10 per cent.

The author also advocates that a hearing aid be worn during all the waking hours of the day. And the instrument should be worn on the better ear. He feels that, contrary to many beliefs, the hearing aid neither weakens the ear nor stimulates the nerve of hearing.

GORDON, Philadelphia.

CONSERVATION OF HEARING. CURRENT COMMENT, J. A. M. A. **132**:717 (Nov. 23) 1946.

A special committee of the American Academy of Ophthalmology and Otolaryngology has projected a long range program for the conservation of hearing. The objectives include, in addition to research on specific otologic diseases, the testing of the hearing of school children and the establishment of state programs to encourage legislation promoting this work. Expansion of programs of testing adults is also recommended. An important part of the program involves the promotion of education regarding the problems facing those who are hard of hearing. The establishment of clinics for the rehabilitation of hearing is to be promoted in cooperation with medical schools, hospitals and already existing clinics. Physicians in general can approve of the objectives defined, and their cooperation is certain.

GORDON, Philadelphia.

LABYRINTHINE DROPSY. J. R. LINDSAY, Laryngoscope **56**:325 (July) 1946.

Lindsay reviews the histopathologic observations made in published cases of labyrinthine dropsy and presents those made in 2 recent cases. Certain of these were unusual. In one case there was rupture of the saccule, and in the other there were localized areas of ossification in two of the semicircular canals and degenerative changes in the vestibular sense organs.

The relation of this and other pathologic evidence to the clinical picture and to the possible cause is discussed.

HITSCHLER, Philadelphia.

THE PROTRUDING EAR AND ITS SURGICAL TREATMENT. A. C. ABBOTT, Manitoba M. Rev. **26**:335 (June) 1946.

Abbott considers it advisable to operate early for correction of prominent ears. He advises operation before the patient enters school, to avoid the emotional effects of ridicule, which not infrequently is experienced by children with conspicuous ears. The ears may be normally formed but abnormally attached, or they may be malformed, with involvement of the anthelix and its crura or an exaggeration of the conchal cavity. Many variations and combinations of these single conditions occur. Ether anesthesia is preferred by this author, without a fixed method but one adapted to the indvidual case for correction. One constant requisite is breaking the "cartilage spring," which holds the ear to the side of the head. If the cartilage of the ear remains unfolded, an elliptic incision is used and the edges inverted to form an anthelix. The ear must remain at the proper angle of 30 degrees from the cranium. If the lobule remains prominent, the cartilaginous portion must be divided to allow the entire ear to fall into the desired plane. A warning is given against the removal of too much skin from the posterior surface of the ear, or the normal sulcus may be obliterated. Surgical gut sutures are used for the soft tissues and cartilage, with fine silk for the skin. Both ears are corrected at one operation, with one hour allowed for each ear. Moist cotton wool is placed both behind and within the ear. This dressing dries to form a firm support. A cotton pad is applied over the entire aural surface, and all is covered by a sponge fastened in place by adhesive strips to give suitable pressure. Over all is drawn a closely fitting operating room cap which has been reenforced with adhesive. Sutures and dressings are removed about the seventh to the tenth day, followed by a bandage, to be worn for three weeks, and then by a nightcap for two to three months.

SELTZER, Philadelphia.

Larynx

EMERGENCY TRACHEOTOMY. EDUARDO ECHEVERRÍA and CARMEN LABRA, Bol. méd. d. Hosp. inf., México **2**:261 (Nov.-Dec.) 1945.

The authors discuss the tracheotomies performed at a hospital where the mortality has been 11 per cent. With a new technic introduced by them, in the last nine months, in 40 cases the fatality rate has been brought down to zero. They first make a careful diagnosis, taking into account all the symptoms. The second step is the operative technic; the authors first do a direct laryngoscopy, which aids in establishing a correct diagnosis, and then introduce a bronchoscope, which is kept in place throughout the operation. The advantage of this procedure is evident from the moment the bronchoscope is placed: The dyspnea stops instantly, and the child ceases to be restless and often falls into a placid sleep. Then, with the respiration assured, an unhurried low tracheotomy is done, in which all the small details can be comfortably attended to. The anesthetic used is a 0.5 to 1 per cent solution of procaine hydrochloride, and in a small amount (not over 4 to 5 cc.). The next step has to do with the postoperative care. The nurse in charge must be well acquainted with all the details of a humid atmosphere, a clean cannula, aspiration, etc. The patient must receive antidiphtheritic serum, sulfonamide drugs, penicillin, etc., depending on the case. The cannula is removed carefully, but as early as possible.

MADERO, México, D. F., Mexico. [AM. J. DIS. CHILD.]

DIFFICULTIES IN REMOVING SOME FOREIGN BODIES FROM THE LOWER AIRWAYS. C. DYKSTRA and C. VERSTEEGH, Nederl. tijdschr. v. geneesk. **88**:149 (Feb. 12-19) 1944.

In order to localize a foreign body in the airways at least two roentgenograms are necessary, an anteroposterior roentgenogram and one exactly perpendicular to the anteroposterior roentgenogram. Such an exact localization is especially important for the bronchoscopist if the foreign bodies are small. This is illustrated by 2 cases observed by the authors. In both cases the foreign body had penetrated into the ventral branches of the bronchial tree, probably because the ventral parts of the lung are best ventilated and the sucking power is greatest in the ventral direction. Both cases had a benign course. In a third case pneumonotomy had to be performed in order to remove the foreign body (a screw), which had caused atelectasis. After the pneumonotomy the lung expanded quickly and completely, and no pleuritis arose, notwithstanding the fact that at the operation a small quantity of pus was removed from the bronchus. In a fourth case the foreign body (also a screw) had caused marked stricture of the lumen of a large bronchus with bronchiectatic changes in the lower lobe of the right lung. After a "cutting" lobectomy had been done, the patient recovered.

VAN CREVELD, Amsterdam, Netherlands. [AM. J. DIS. CHILD.]

Nose

OXIDIZED CELLULOSE GAUZE PACKING FOR NASAL BLEEDING. KARL M. HOUSER, J. A. M. A. **132**:143 (Sept. 21) 1946.

Houser points out the value of oxidized cellulose in the control of certain types of nasal bleeding. He has used it in about 50 cases of nasal bleeding secondary to traumatic, surgical or spontaneous causes. He quotes the views of Frantz and Lattes in their experiences with this type of packing.

The packing is inserted in sufficient quantity and with sufficient pressure to control the bleeding and is never removed. After thirty-six hours the pack will have disintegrated, and twenty-four hours thereafter it will be a jelly-like mass that comes away without instrumentation.

The preparation is obtained as ½ inch (1.27 cm.) oxidized cellulose gauze packing.

GORDON, Philadelphia.

USE OF ANTIRETICULAR CYTOTOXIC SERUM (ACS) IN ATROPHIC RHINITIS (OZENA). C. C. ROE JACKSON, Laryngoscope **56**:342 (July) 1946.

The Russians have been enthusiastic about antireticular cytotoxic serum (ACS), which has been used in many pathologic conditions.

They feel that "the physiologic system of the connective tissue is the arena in which pathologic processes develop and that there are no diseases of the body whose development and course are not actively affected by the connective tissues; therefore, the maintenance of this system on a sufficient level of activity, is one of the most important problems of therapy." Antireticular cytotoxic serum in small doses is supposed to accomplish this.

The Russians report marked success in the treatment of atrophic rhinitis. Jackson used such serum in 24 cases. Although there was some improvement in his patients, the results did not compare with those of the Russians. Why this is so is uncertain. More cases should be studied and for longer periods in order to obtain a proper evaluation of the treatment.

HITSCHLER, Philadelphia.

Miscellaneous

THE MANAGEMENT OF BACTERIAL INFECTIONS OF THE SKIN. DONALD M. PILLSBURY, J. A. M. A. **132**:692 (Nov. 23) 1946.

The author, a distinguished dermatologist, discusses the classification of cutaneous infections, the bacteriologic considerations and the theories thereof, some allergic phases and the over-all management.

The otolaryngologist is especially interested in certain dermatologic conditions that he encounters in the external auditory canal, the nasal vestibules, the ala nasi and the nasal dorsum.

The author clearly presents the various regimens of treatment in vogue today, with comments from his own vast experience.

This abstracter was struck by the highly informative discussion of: cutaneous self disinfection; superficial bacterial infection as a sensitizing agent; the clinical management of pyodermas; the merits and demerits of sulfonamide compounds and penicillin, the latter as given orally, locally and parenterally; local hygiene; the administration of ammoniated mercury, gentian violet medicinal, acriflavine, Castellani's carbolfuchsin paint and silver nitrate (the latter used in 0.1 per cent strength if compresses are used in 1 per cent aqueous solution when painted on). The author also tells how to cleanse the skin gently and remove the debris.

The otologist must become dermatologically minded when he treats the external aural canal and the external nares, as well as when he plans the preoperative preparation and postoperative management of patients with rhinitic and otitic infection.

GORDON, Philadelphia.

HISTAMINE AND ANTIHISTAMINIC AGENTS: THEIR EXPERIMENTAL AND THERAPEUTIC STATUS. SAMUEL M. FEINBERG, J. A. M. A. **132**:702 (Nov. 23) 1946.

Feinberg reviews in detail the most important considerations of the histamine reaction of the body and the many experiments that have been carried out since the turn of the century. He discusses histamine and its role in the mechanism of anaphylaxis and allergy, histamine therapy and tolerance, histamine-azoprotein, histaminase, sympathomimetic drugs, early antihistaminic agents, recent French antihistaminic drugs (compounds prepared by M. Mosnier in the chemical laboratories of the Rhone-Poulenc Society of Chemical Manufacturing), new American histamine antagonists and comparative studies.

He feels that Benadryl (beta-dimethylaminoethyl benzohydryl ether hydrochloride) and Pyribenzamine (N'pyridil-N'benzyl-N-dimethylethylenediamine) as used against perennial vasomotor rhinitis and asthma are of more limited usefulness

than some of the other agents found helpful in numerous dermatitic allergic states. Benadryl has given many side reactions that were not good. He closes his summary as follows: "The use of these histamine antagonists should be tempered with the following considerations: A cure or lasting improvement is not to be anticipated as a result of the action of these drugs; at best they exert only a temporary palliative action in allergic conditions. Many manifestations and many patients will fail to respond to them, and others will be helped by the employment of additional palliative measures. The specific allergic methods (elimination and desensitization) should not be abandoned, as at present they constitute the sole means of achieving lasting results. In addition to precautions against immediate toxic reactions, it should be remembered that the remote toxicity from these drugs has not been sufficiently ascertained up to this time.

GORDON, Philadelphia.

DIET AND MAN'S TOLERANCE TO COLD. Editorial, J. A. M. A. **132**:716 (Nov. 23) 1946.

Careful studies are here outlined which clearly indicate that the ability of man to withstand the damaging effects of being repeatedly exposed to cold cannot be appreciably altered by giving ascorbic acid, thiamine, riboflavin and nicotinic acid in doses exceeding the amounts required for apparently normal nutrition. The possibility that the water-soluble vitamins might show a favorable effect in subjects with definite avitaminosis, of course, is not answered by these experiments.

GORDON, Philadelphia.

POLIOMYELITIS PORT OF ENTRY. EDITORIAL, J. A. M. A. **132**:716 (Nov. 23) 1946.

It is believed now by those who have investigated human material that the olfactory nervous system is rarely involved. From recent work Faber and his associates have been led to conclude that there is no single port of entry for the virus of human poliomyelitis. Almost any nerve system with peripheral endings in the mucous surfaces can, if exposed, convey the virus in a central direction to its regional ganglions and thence, if the process continues, into the central nervous system. Their limited statistical evidence suggests the following relative frequencies of primary infection: (1) trigeminal afferent system (fifth cranial) very frequent; (2) visceral afferent system (ninth and tenth cranial) fairly common but less than the fifth; (3) gustatory system (seventh, ninth and tenth cranial) occasional; (4) sympathetic systems, upper levels (pharynx, bronchial tree, upper part of the esophagus) occasional; (5) sympathetic system, lower (intestine) doubtful; (6) vagal efferent (parasympathetic) system (ninth cranial) and olfactory system (first cranial) uninvolved.

The pharynx thus appears to be an especially favorable site for the primary penetration of poliomyelitis virus. Clinically there is apparently no constant correlation between the site (or level) of the initial penetration and the site or the severity of the initial paralysis.

GORDON, Philadelphia.

VACCINATION OF MILITARY PERSONNEL AGAINST INFLUENZA. J. A. M. A. **132**: 720 (Nov. 23) 1946.

After a discussion of the project of vaccinating military personnel during the fall and winter of 1946 and 1947, and of plans for installations in continental United States and overseas, it has been decided that a single dose of 1 cc. of the vaccine will be administered subcutaneously, not so much as a precautionary measure but as a specific control procedure to be applied if definite occasion arises. No vaccine will be given to those who are sensitive to eggs, and vaccination will be withheld from them until further investigations rule out egg sensitivity.

GORDON, Philadelphia.

HAY FEVER AND ASTHMA FOLLOWING MAXIMUM EXPOSURE TO RAGWEED. FRANK L. ROSEN, J. A. M. A. **132**:854 (Dec. 7) 1946.

Rosen reports an interesting case in which a soldier giving a history of mild nasal allergy while residing in his own home town exhibited severe nasal and bronchial allergy when stationed at a camp having the highest ragweed pollen count. He states that perhaps similar cases will crop up as time goes on and that the final decision of the Disability Rating Boards of the Veterans Administration will be most difficult as to the question of compensation. As to the latter, he suggests that trained allergists might be the best ones to render a fair decision. Nonetheless the Disability Rating Boards will be plagued for a long time to come when rendering judgment in such cases.

He describes this interesting case in moderate detail, and it is informative.

GORDON, Philadelphia.

ANTIBIOTICS AND THE CENTRAL NERVOUS SYSTEM. EDITORIAL, J. A. M. A. **132**: 860 (Dec. 7) 1946.

Investigations of the influence of penicillin on the central nervous system reveal toxic manifestations when the dosage used is above therapeutic requirements. This is fortunate.

Streptomycin, actinomycin and clavacin showed effects similar to those of penicillin, but it is important to note that they caused severe toxic effects in concentrations little, if at all, above therapeutic levels. They would not be acceptable for clinical use in the treatment of the central nervous system even if they were free from systemic toxic effects.

As far as penicillin and streptomycin are concerned, the margin between the therapeutic concentration and the convulsive threshold is so great that with reasonable care the toxic effects should be avoidable.

GORDON, Philadelphia.

SURGICAL MANAGEMENT OF INFECTIOUS ASTHMA. F. D. WOODWARD, J. Allergy **17**:260 (Sept.) 1946.

Otolaryngologists and allergists are urged to collaborate in order to obtain best results in the treatment of patients with infectious asthma. The author proposes that allergists be trained in otolaryngologic diagnosis and that otolaryngologists become thoroughly conversant with the field of allergy. Treatment of acute, subacute and chronic sinusitis is discussed from both the conservative and the more extensive surgical approaches. It is felt that surgical treatment of the sinuses of asthmatic patients should neither be condemned nor expected to cure the asthma. Rather, the goals to be sought are the elimination of pain, the restoration of airways, the decrease of discharge and of toxemia, the protection of the lungs from chronic changes and the elimination of active foci of infection. A combination of adequate surgical treatment of the sinuses and allergic management seems to offer the most favorable end results.

FRIEDBERG, Chicago.

IS THERE A WORD FOR APHASICS? JEANETTE O. ANDERSON, Quart. J. Speech **32**:485, 1946.

No satisfactory definition of aphasia exists. A working concept defines aphasia as a basic disorder of symbolization that may exhibit any combination of many aphasic manifestations. These manifestations may be classified as expressive, receptive, associative and mixed. A crucial issue in the retraining of aphasic patients, either children or adults, is the possession by the patient of an actual literal word received and/or produced by the patient who has been deprived prenatally, natally or postnatally of "propositional speech." In almost every case there is such a word, and in every case in which there is such a word other words can be trained in. From one to six years of such training may be expected. After an

initial period of training varying in length from patient to patient, each patient tends to reach a plateau somewhere short of his former level of excellence. Many patients learn to speak, write and read enough to carry on uncomplicated lives at home or at simple employment. Neither the aphasic child nor the aphasic adult profits from speech correction until he wants so much to express his inner verbalizations that he spontaneously attempts some form of overt communication. He may do this orally, manually or graphically, but it must be ontogenetic. Children learn well when objects, toys, pictures and situations are associated with speech sounds. Adults seem to learn better from written or printed symbols than from the reality. A cat, for example, will not stimulate the patient to say the word "cat" as effectively as the written representation or the picture unless the patient feels strongly about cats. Strongly emotional stimuli are to be avoided because they lead in the aphasic, even more than in the so-called normal, person to noncortical language, to uncontrolled speech, to excesses of emotion which inhibit rather than stimulate volitional speech. Aphasic persons must be guarded from emotional excesses. The cortex is damaged, and this damage reduces the effects of all the functions of the cortex, with consequent emotional peculiarities of behavior. Temper tantrums, laughing and crying without moderation, hysteria, rapid changes of mood are all common in aphasic persons and are often charged against the psychosis rather than against the condition itself. Aphasic patients who are ready for speech training are usually babbling and in other ways reproducing the early stages of the normal development of speech. Phonetic drills and the incorporation of speech sounds into nonsense syllables seem useful only as they are made an integral part of the normal developmental process. Of themselves, they are valueless in the training of aphasia.

There are many approaches to the learning of speech: e. g., visual, auditory, kinesthetic. To some extent, the olfactory and gustatory images of language are also valuable. A combination of sensory approaches usually produces better results than only one stimulus presented in the language way. The cortex appears to function as a unit, and recovery in these cases appears to be the result of a reorganization of the entire central nervous system. Any interference affecting the extreme selectivity and specificity of the central nervous system is reflected throughout the system and its activities. Thus, in speech correction the work with an aphasic patient is never limited to the speech mechanics but has to be directed to the entire person. Speech is the expression of an individual's mode of experience. Speech is taught never as an entity, an end in itself, but always as an integral part of the business of living. Aphasic patients may therefore progress (1) if there is no progressive destruction of brain tissue, (2) if there is no previous history of inability to learn language for other reasons than the aphasia, (3) if the patient has attempted spontaneously to communicate, (4) if regular skilled daily speech training is adapted to each patient's abilities and linguistic residues and incorporated into his way of life.

PALMER, Wichita, Kan.

REPAIR OF FACIAL DEFECTS BY LOW-NECK PEDICLE FLAPS. R. H. IVY, Plastic & Reconstr. Surg. **1**:119 (Sept.) 1946.

Ivy emphasizes two points of special importance in operating on the face for the repair of tissue defects: (1) a careful attempt to avoid greater scarring; (2) the use of graft material matching the skin of the face in both texture and color. The author's method of fulfilling these requirements, while not claimed to be original, has not been given the wide notice which he considers desirable. Tube pedicle flaps are taken from the lower segment of the neck, the skin of which is much the same in color and texture as that of the face. The scar which results at the lower extremity of the neck is not notable and can be as easily covered by clothing as that resulting from a thyroidectomy. Horizontal incisions are made, which may extend across the midline, if necessary, for sufficient length. Although it is possible to secure good results without leaving a tissue bridge at the midline, it is safer to take this precaution, in order to avoid possible thrombosis and necrosis

at this place. After an interval of ten days or more, the tube can be completed. Skin and subcutaneous tissue should be incised down to the superficial fascia, without inclusion of the underlying muscle. If the edges of the wound are then undercut, they can be approximated without too much tension. Case histories are included, with excellent illustrations of the use of this method of repairing nose, cheek and ear.

SELTZER, Philadelphia.

FURTHER USES OF THE SICKLE FLAP IN PLASTIC SURGERY. G. B. NEW, Plastic & Reconstructive Surg. **1**:271 (Nov.) 1946.

New finds that the usefulness of the sickle flap has been much extended as a means of reconstruction of many defects occurring about the face. It has proved to be less suitable in reformation of the nasal tip and in total reconstruction of the nose unless the midline attachment is made rather than the lateral attachment. In the latter case, there is apt to result a pulling to one side. Cases are presented illustrating the use of this method of grafting in reconstructions of the nose, the cheek, the lips and the eyelids, also cases with some of these conditions combined. The results of the technic have been generally satisfactory.

SELTZER, Philadelphia.

THE SPLIT THICKNESS GRAFT A USEFUL ADJUNCT IN TUBE PEDICLE PREPARATION. W. W. MACOMBER, Surg., Gynec. & Obst. **84**:97 (Jan.) 1947.

Macomber presents a method of covering the donor site with a split skin graft under the pedicle. He has found that this method not only helps one to avoid infection but prevents contraction of the angles, which is of importance in the use of the pedicle graft. It also contributes to the maintenance of better circulation at the angles. Common sites for the removal of graft are (1) the abdominal-thoracic region, (2) the inner surface of the thigh, (3) the cervical-thoracic region and (4) the upper arm. The site must be determined by the requirements of the operation to be performed. The author reports rapid healing of operative wounds and few complications.

SELTZER, Philadelphia.

Book Reviews

The Diagnosis and Treatment of Bronchial Asthma. By Leslie N. Gay, M D., assistant professor of medicine, Johns Hopkins University School of Medicine. Pp. 324. Baltimore: Williams & Wilkins Company, 1946.

In this small monograph on bronchial asthma there is indeed a wealth of knowledge and experience. Case reports are packed with vital information. Irrelevant material has been cut to the bone.

The common errors of differential diagnosis are so vividly portrayed that one feels he will never again mistake cardiac asthma, simple emphysema or myocardial degeneration for bronchial asthma. The pros and cons of surgical treatment, especially those of the treatment of the sinuses, are given with the utmost fairness, and the presentation should be particularly gratifying to the operating otolaryngologist.

Much is to be learned from the painstaking and exact descriptions of the autopsy material examined in cases of bronchial asthma.

Short, accurate outlines of concise treatments for the various groups of patients are given. If one keeps in mind that asthma may be caused by specific allergens, and perhaps by bacterial allergens, with sinus infection superimposed, one has a head start on how to alleviate this dread malady. The importance of a complete and painstaking history is stressed, with the heredity, the beginning of attacks, the seasons and other factors especially brought out.

Treatment then starts in earnest with avoidance of allergens, with hair pillows being substituted for feather pillows, mattresses encased, dusts, animal danders, pollens and orris root found out and treated for, and certain common foods, such as egg, wheat, milk, cabbage, cucumbers, onions and peppers, eliminated when necessary.

Emergency treatment is handled admirably, and the author shows how necessary it is to have alternative measures at one's finger tips. He mentions in great detail the use of solutions of epinephrine hydrochloride 1 : 1,000 and 1 : 100, suspensions of epinephrine salts 1 : 1,000 in peanut oil, oxygen, oxygen 20 per cent–helium 80 per cent mixtures, theophylline ethylenediamine 0.2 to 0.4 Gm. in 10 cc. of isotonic solution of sodium chloride injected intravenously, and 50 per cent sucrose up to 100 cc. injected intravenously, slowly, over a period of one-half hour at least.

There is little that is really dogmatic except his discussion of the regeneration of the mucous membrane of the maxillary antrum, wherein he states that only stratified squamous epithelium returns and that no mucus-producing glands are present. McGregor and Knowlton, Coates and Ersner and others have shown differently. Normal mucous membrane does return, normal histologically and functionally.

However, as a whole the book is of real value to general practitioners as the front line physicians and to internists, otolaryngologists and thoracic surgeons as the final consultants.

Ophthalmology of the War Years. Edited by Meyer Wiener, M.D. Volume I (1940-1943). Chicago: The Year Book Publishers, Inc., 1946.

For those ophthalmologists whose service with the armed forces during the war years made it difficult or impossible to keep abreast of the current ophthalmologic literature this book has been compiled. Articles from all obtainable publications have been grouped under thirty-two subheadings, from "Anatomy and Embryology" to "Diseases of the Uveal Tract," and each group of articles is digested and discussed by an associate editor. Following every chapter is a

bibliography of the articles covered. A second volume, treating the literature from 1944 to 1946 in a similar fashion, is planned for 1947.

While the book is designed primarily for the ophthalmologist there are some matters touched upon which have an interest for the otolaryngologist. A study has been made of the relationship between sinusitis and chronic simple glaucoma. Of 53 patients with both afflictions, 37 had involvement of nose and eye on the same side or, when bilateral, greater involvement of both on the same side; 6 more had equal involvement on the two sides. In no case was there marked disease of the eye on one side associated with marked nasal disease on the opposite side. One author believes that unilateral disease of the nose or of the accessory sinuses favors the more rapid progress of trachoma in the eye on the same side.

Several articles have been written on the Vogt-Koyanagi syndrome (severe uveitis associated with alopecia, vitiligo and poliosis). It is noted that partial deafness occurs in 72 per cent of these cases, and may also be found in cases of Harada's disease (exudative chorioretinitis with detachment of the retina).

The section entitled "Orbit, Eyeball and Sinuses" contains a fair amount of pertinent material. The modes by which inflammatory processes are transmitted from sinuses to orbit are listed as (1) thrombophlebitis, (2) direct extension through dehiscences and (3) erosion of the common wall between the affected sinus and the orbit. The commonest cause of orbital cellulitis is acute sinusitis (70 to 80 per cent). Two authors agree that the frontal sinus is the cause in most of the adult patients, but there is some difference of opinion in regard to children: three authors name the ethmoid sinus and one the maxillary antrum.

At other points reference is made to emphysema of the soft tissues of the orbit as a sign of fracture into one of the accessory sinuses; to osseous dystrophies in which growths extend from the ethmoid cells into the cranial cavity and orbit; and to osteomas, derived from fragments of cartilage connected with the ethmoid cells, which invade the frontal and maxillary sinuses and the orbit. A case in the last category that resulted in complete bilateral optic atrophy is presented.

This method of reviewing current work before it appears in textbook form offers many conveniences and might well be used in the future in other medical fields. In many cases one should read the original article, but this is itself facilitated by the extensive bibliographies.

News and Comment

GENERAL NEWS

Home Study Courses, American Academy of Ophthalmology and Otolaryngology.—The Home Study Courses in the basic sciences of the two specialties, sponsored by the American Academy of Ophthalmology and Otolaryngology, will be given again beginning Sept. 1, 1947. Registrations must be completed before August 15. Detailed information may be secured from Dr. William L. Benedict, executive secretary, 100 First Avenue Building, Rochester, Minn.

Directory of Otolaryngologic Societies *

INTERNATIONAL

First Pan-American Congress of Oto-Rhino-Laryngology and Bronchoesophagology

President: Dr. Gordon B. New, Mayo Clinic, Rochester, Minn.
Secretary: Dr. Chevalier L. Jackson, 255 S. 17th St., Philadelphia 3.

NATIONAL

American Medical Association, Scientific Assembly, Section on Laryngology, Otology and Rhinology

Chairman: Dr. J. Mackenzie Brown, 1136 W. 6th St., Los Angeles.
Secretary: Dr. Fletcher D. Woodward, 104 E. Market St., Charlottesville, Va.
Place: Atlantic City. Time: June 9-13, 1947.

American Academy of Ophthalmology and Otolaryngology

President: Dr. Alan C. Woods, Johns Hopkins Hospital, Baltimore 5.
President-Elect: Dr. C. H. McCaskey, 20 N. Meridian St., Indianapolis, Ind.
Executive Secretary-Treasurer: Dr. William L. Benedict, 100–1st Ave. Bldg., Rochester, Minn.
Place: Palmer House, Chicago. Time: Oct. 12-17, 1947.

American Broncho-Esophagological Association

President: Dr. Robert M. Lukens, Medical Arts Bldg., Philadelphia 2.
Secretary: Dr. Paul Holinger, 700 N. Michigan Ave., Chicago 11.
Place: Hotel Brighton, Atlantic City. Time: June 9, 1947.

American Laryngological Association

President: Dr. Frank R. Spencer, Physicians Bldg., Boulder, Colo.
Secretary: Dr. Arthur W. Proetz, Beaumont Bldg., St. Louis.
Place: Hotel Statler, St. Louis. Time: April 23-24, 1947.

American Laryngological, Rhinological and Otological Society, Inc.

President: Dr. Harry W. Lyman, 906 Carleton Bldg., St. Louis.
Secretary: Dr. C. Stewart Nash, 708 Medical Arts Bldg., Rochester 7, N. Y.
Place: Hotel Statler, St. Louis. Time: April 25-26, 1947.

SECTIONS:

Eastern.—Chairman: Dr. Robert F. Ridpath, 18th and Chestnut Sts., Philadelphia.
Southern.—Chairman: Dr. Walter T. Hotchkiss, 541 Lincoln Rd., Miami Beach, Fla.
Middle.—Chairman: Dr. Oliver E. Van Alyea, 135 S. La Salle St., Chicago.
Western.—Chairman: Dr. Colby Hall, 1136 W. 6th St., Los Angeles, Calif.

American Otological Society

President: Dr. William E. Grove, 324 E. Wisconsin Ave., Milwaukee, Wis.
Secretary: Dr. Gordon D. Hoople, 713 E. Genesee St., Syracuse, N. Y.
Place: Hotel Statler, St. Louis. Time: April 21-22, 1947.

American Otorhinologic Society for the Advancement of Plastic and Reconstructive Surgery, Inc.

President: Dr. Alfred Schattner, 115 E. 61st St., New York.
Secretary: Dr. Norman N. Smith, 291 Whitney Ave., New Haven, Conn.

* Secretaries of societies are requested to furnish the information necessary to keep this list up to date.